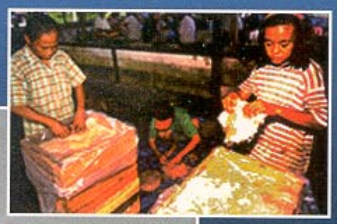
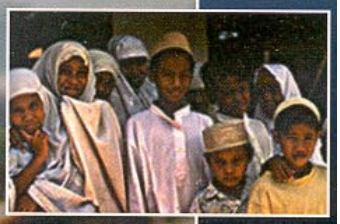
Assessing Behavioral Aspects of Coastal Resource Use

by Richard B. Pollnac and Brian R. Crawford





ASSESSING BEHAVIORAL ASPECTS OF COASTAL RESOURCE USE

by

Richard B. Pollnac and Brian R. Crawford

Proyek Pesisir, CRC/URI CRMP, NRM Secretariat, Ratu Plaza Building 18th Floor
Jl. Jenderal Sudirman 9, Jakarta Selatan 10270, Indonesia
Phone: (62-21) 720-9596 Fax: (62-21) 720-7844 Email: crmp@cbn.net.id

ASSESSING BEHAVIORAL ASPECTS OF COASTAL RESOURCE USE

By
Richard B. Pollnac and Brian R. Crawford

Funding for preparation and printing of this document was provided by USAID as part of the
USAID/BAPPENAS Natural Resources Management (NRM) Program
and
USAID-CRC/URI Coastal Resources Management Program.

Further details of Proyek Pesisir publications can be found at www.indomarine.or.id
Further details of NRM publications can be found at www.nrm.or.id
Further details of CRM Program publications can be found at www.crc.uri.edu

Printed in Narragansett, Rhode Island USA

Citation:
Pollnac, Richard B. and B.R. Crawford (2000), ASSESSING BEHAVIORAL ASPECTS OF COASTAL RESOURCE USE. Proyek Pesisir Publications Special Report. Coastal Resources Center Coastal Management Report #2226. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island. 139 pages.

Credits:

Maps: A. Siahainenia
Layout: David Kendrick
Edited by: Alice Barrows and Chip Young
ISBN: 1–885454–35–8

TABLE OF CONTENTS

LIST OF EXAMPLES

LIST OF FIGURES

LIST OF TABLES

FOREWORD

Understanding the human aspects of coastal resources use is essential for effective coastal management, especially community-based coastal resources management (CB-CRM). Inclusion of good information is essential if coastal managers are to ultimately demonstrate the benefits and impacts of CB-CRM. This manual breaks new ground in providing guidance for collecting and utilizing rigorous quantitative and qualitative data as part of CB-CRM efforts as a complement to information collected through more participatory methods.

The Coastal Resources Center, through the Indonesia Coastal Resources Management Project, known in-country as Proyek Pesisir, has been working to develop and test integrated management approaches and practices that can be effective in the Indonesian context. Community-based coastal resources management is one "good practice" model being pioneered in North Sulawesi. While experience in CB-CRM throughout Asia and globally is rapidly growing, Proyek Pesisir's pilot efforts in three North Sulawesi sites—Blongko, Talise and Bentenan-Tumbak—are among the first such sustained initiatives in Indonesia. Since 1997, Proyek Pesisir has been working with these communities to prepare community profiles and CB-CRM plans. In late 1999, the plans were adopted by the communities themselves, as well as by the village leaders and the Minahasa Regency, making CB-CRM tangible in Indonesia.

Since it is our aspiration that these pioneering CB-CRM programs will be both an inspiration and example for many of Indonesia's over 6,000 coastal villages, Proyek Pesisir made a major commitment to take a "scientific" approach to developing our model of CB-CRM. Such an approach seemed essential if we were to be able at the end of the project to say with confidence what impact the CB-CRM projects had; as well as where and how this approach should be replicated. While methodologies to look at the natural environment are relatively well-developed (and are not covered in this manual), practical methodologies aimed at understanding the human aspects of coastal resources use are few. Such information is essential for selecting CB-CRM sites, identifying and understanding coastal resource management issues, and importantly, demonstrating the benefits and impacts of CB-CRM.

The manual, which is targeted at coastal managers and professional social scientists, presents methodologies to facilitate more quantitative approaches to establishing and assessing

the impacts of CB-CRM projects. The methodological information is complemented with practical guidance about acquiring information in the field; and the utility of the information demonstrated through the use of a wide range of field examples from both North Sulawesi and other nations working to establish viable CB-CRM. While developed for Indonesia, we believe the manual will be useful to practitioners globally as the problems it is designed to address—that of inadequate information on the human aspects of coastal resource use and the assessment of project results—are near universal.

As with any instrument, this guide needs to be applied carefully and appropriately. We commend it to you as a research tool that can augment the essential participatory processes that are at the core of CB-CRM. We encourage your feedback to the authors on your experience with its application.

Ian M. Dutton
Chief of Party, Proyek Pesisir
Jakarta

Lynne Zeitlin Hale
Associate Director, CRC
University of Rhode Island

1

INTRODUCTION

1.1 BACKGROUND

The purpose of this manual is to provide guidelines for assessing the behavioral aspects of resource use for community-based coastal resources management (CB-CRM) projects. Why? First, we must be accountable in terms of justifying the money, time, and resources expended on such a project. We must be accountable to the people who support the governments and organizations that fund these projects. We must also be accountable to the coastal communities that invest their time and labor, and take the ultimate risk that the CRM measures will improve, not diminish, their quality of life. They must be provided with some sort of report card that informs them of a CB-CRM project's progress and impact (Harwell et al. 1999).

Second, CB-CRM project management requires feedback on progress toward goals and objectives, so that, if need be, activities can be adjusted to fit the dynamics of change in coastal populations. This type of adjustment is referred to as adaptive management—a must in ecosystem management (Margoluis and Salafsky 1998).

Third, over the past decade there has been an explosion of interest in CB-CRM. This interest reflects a perspective that local resource users, those that depend on coastal resources for their livelihood and well-being, should have a strong voice in the resource management. This interest also reflects an assumption, as yet unsubstantiated, that a community-based approach will yield more effective management. As a result, we find many countries around the world shifting policy toward decentralization and community-based management. Along with this shift, there is a growing body of literature directed at understanding how CB-CRM initiatives should be carried out, identifying factors that most likely will lead to success (Brown 1998, Polotan-de la Cruz 1993, Pomeroy and Carlos 1997, Pomeroy et al. 1996, 1997, Pomeroy 1994b, Talaue-McManus and Chua 1997, van Mulekom 1999, White et al. 1994b, White 1989, World Bank 1999). With notable exceptions (Pomeroy et al. 1996, 1997; Pomeroy and Carlos 1997; World Bank 1999), much of the literature is based on case studies conducted by many different individuals, with unknown biases, and varying research methodologies and disciplinary perspectives. Much of it lacks adequate baseline data for determining the socioeconomic impacts of CB-CRM, and none, as far as we know, uses control sites (non-project sites) to separate project impacts from other factors.

While such information has been useful to practitioners for building enthusiasm for the community-based approach, as well as adapting CB-CRM approaches to new situations, it is important to begin supplementing that approach with more systematic methods. These methods will facilitate rigorous documentation of issues, testing of project logic/hypotheses, and evaluation of project impacts. The methods described in this manual emphasize a systematic, empirical approach to obtaining detailed evidence of outcomes that can be attributed to a specific set of project interventions. Specifically, the methods allow testing hypotheses concerning what constitutes best practices in the process of developing CB-CRM.

1.2 PURPOSE AND SCOPE

The purpose of this manual is to help coastal program managers and scientists incorporate systematic qualitative and quantitative assessment methods into the process-oriented work that is essential for viable community-based management. Specifically, the manual provides guidelines for assessing behavioral aspects of resource use for community-based coastal resources management projects. The emphasis is on human behaviors, factors influencing these behaviors, and the consequences of these behaviors for community well-being.

It is important to emphasize that the use of the concept "behavioral" is deliberate. Many non-social scientists refer to all information on human behavior as "socioeconomic," even when it includes obviously psychological factors such as attitudes, beliefs and values. Technically, socioeconomic involves only social and economic factors, neglecting the attitudes, beliefs and values that motivate much of human behavior. Another important aspect of behavior that is neglected, in a strictly socioeconomic assessment, is the behavioral aspect of the deployment of technology. While socioeconomic studies consider technology—its costs, ownership and production—they usually omit descriptions of how the technology is used. Exactly the same technology can have completely different impacts on a natural resource when it is deployed in different ways. For example, some net deployment methods result in entanglement in corals—breaking and otherwise damaging the living organism. Hence, this manual also includes methods for describing significant aspects of behavior associated with technology.

Human behavior cannot be assessed in isolation from the biophysical environment. Humans cut down trees, till the soil, catch fish, mine coral, etc. Since these behaviors impact coastal ecosystem health, it is necessary to include relevant aspects of the biophysical environment (species exploited and techniques used, land use practices) in long term assessments of CB-CRM projects. Assessment of biophysical factors, while mentioned, is not the emphasis of this manual, as other excellent guides are available for this purpose (English et al. 1994, Fox 1986, McManus et al. 1997). For the most part, the methods described in this manual have been used by Proyek Pesisir (the local name for the

Indonesian Coastal Resources Management Project, a cooperative effort of the U.S. Agency for International Development (USAID) and the Indonesia National Development Planning Board (BAPPENAS)) in its ongoing research, development and testing of best practice models for CB-CRM in North Sulawesi, Indonesia.

A key assumption of this manual, with its emphasis on assessing human aspects of coastal resource use, is that the ultimate goal of CB-CRM is improvement of coastal ecosystem health, resulting in improvement in the quality of life for coastal communities. There are often different interpretations of what is meant by "community-level" with respect to CB-CRM programs. In this manual, we define community-level sites as areas encompassing:

- A coastal sub-village, a village, or several villages located on a small island or surrounding a small bay or estuary
- A collection of villages or sub-villages that uses the resources (for example, fish, coral, sand, mangroves) of a common coastal area
- A subgroup within a village that exploits a small ecosystem unit or collection of coastal resources within one area

Several recent handbooks and guides have included methods for appraising the socioeconomic and human behavioral aspects of resource use in coastal communities and CB-CRM programs (Pido et al. 1996, Townsley 1993, Pollnac 1998, Olsen et al. 1999, Walters et al. 1998, IIRR 1998, EPA 1994). While including useful methods, most have been either rather specific or too general. Pido et al. (1996) focus on a research process designed to quickly document and evaluate existing local fisheries management systems. Pollnac (1998) describes a set of indicators covering the range of human factors potentially impacting coral reefs. Data on the indicators can be derived from primary research, existing literature or some combination thereof. The purpose of Pollnac's 1998 guide is to provide a method for obtaining systematic data to enter in a worldwide database on coral reefs for quantitative analysis, as well as to provide basic information on related human populations. Townsley's (1993) excellent manual describes a range of techniques for use in rapid appraisal of small-scale fishing in coastal communities. It is intended as an introduction to rapid appraisal techniques. Walters et al. (1998) focus on participatory assessment. A more extensive and detailed description of participatory assessment is provided by the International Institute for Rural Reconstruction (IIRR) (1998) three-volume series which emphasizes Philippine experience with participatory methods in all phases of the community-based coastal resources management process. It contains sections on assessment and monitoring, including biophysical parameters, as well as the socioeconomic and human aspects of resource use in coastal communities. The U.S. Environmental Protection Agency (EPA) has produced a guide (EPA, 1994) for outcome assessment of estuary management projects. The EPA guide focuses specifically on estuary ecosystems and contains guidance on evaluating governance, household and business activities, and environmental conditions (primarily pollution-related

factors). Finally, Olsen et al. (1999) developed a manual to assess the management capacity of a coastal management program. It reflects a qualitative approach to drawing lessons, with an emphasis on governance practices and interventions. Posing a series of questions at various stages in the program cycle, it is geared toward regional and national programs, rather than community-based initiatives.

1.3 LINKING THIS GUIDE TO PARTICIPATORY ASSESSMENTS

Emphasis in this manual is not placed on participatory methods. It is directed at obtaining systematic qualitative and quantitative data, and where appropriate, conducting statistical analysis of the information gathered. The use of participatory methods for obtaining some data, however, is not automatically ruled out. They are frequently an essential element of CB-CRM projects, and the fact they are not emphasized in this guide does not suggest otherwise. Participatory approaches are useful to help build community support for a CB-CRM initiative, to draw on the traditional community knowledge base, to raise awareness of socioeconomic and ecological trends and changes within the community, and to build community capacity for sustained local-level management. Participatory methods are not, however, always feasible, given the time constraints which often accompany CRM projects, particularly in the project site selection phase. They also have a number of limitations, usually requiring extensive preparation time if properly used, and having the potential of resulting in subjective information with a relatively high level of community perceptual biases. This is a potential drawback to the participatory method, since when developing or testing new approaches, decisionmakers often demand objective evidence that the new approach indeed delivered the intended benefits. Nevertheless, a participatory process is an essential element of any CB-CRM effort. A participatory community planning and management process must be carried out concurrent with, or immediately following, baseline assessment work. Results of the baseline assessments must then be fed back to the community and linked to the planning process. This guide sets forth methodologies for collecting data which complement, but do not replace, participatory assessment techniques.

1.4 IN WHAT SITUATIONS SHOULD THIS MANUAL BE USED?

The manual is directed at projects where CB-CRM is used as an important intervention, either alone or in combination with other approaches, to improve management of the coastal resources of a defined region (large bay, province, etc.). It assumes that a few communities will be selected to develop pilot projects, and that broader impact will be achieved through the later replication of successful project interventions. Projects with such design features should find the methods described in this guide useful. However, the methods

described here must be evaluated in terms of their suitability for specific projects. If necessary, they can be adapted and carefully applied to other situations.

Once the pilot phase of CB-CRM is completed in an area, and the program is in the replication phase, neither the resources to conduct the extensive baseline assessments described in this manual may be available, nor the full suite of data described herein deemed necessary. In such cases, a subset of the recommended data may be more appropriate, and participatory methods could play a more prominent role. However, if less information is collected, then the knowledge base from which project intervention decisions are made is more limited. This increases the risk that important pieces of information may be missing, and that project decisions may therefore not have intended outcomes. The project team must weigh the level of information considered necessary against available resources. Finally, as with any assessment methodology, attention needs to be given to ensure that the assessment team has the experience and skills, as well as the resources, to apply the methods recommended in this guide.

1.5 WHO SHOULD USE THIS MANUAL?

This manual is directed at socioeconomic specialists and technical staff working on CB-CRM programs and projects. The information and reports developed from the application of the assessment methods described are appropriate for a technical audience. While the information obtained is useful for profiling human aspects of coastal resource use, the data acquired will not be in a format that is easily understood by client groups at the village level or by local government officials. Hence, additional steps are needed to ensure that the information collected through the methods in this manual is simplified and integrated into documents produced as part of a project's participatory process. For example, in the first phase of the CB-CRM process, issue identification, projects typically develop a site profile document. The profile should involve a high degree of community input to identify key coastal resources management issues, document actual and perceived trends in resource condition and use, and help explain the causes and consequences of observed phenomena. Systematically collected quantitative and qualitative baseline information (both socioeconomic and environmental), presented in a form easily understood by community members and local government officials, is an important component of such a profile.

1.6 ORGANIZATION OF THE MANUAL

This guide presents sampling methodologies and examples of data collection, plus analysis and presentation for three types of activities that are found in all CB-CRM projects. Although many of the examples are drawn from Proyek Pesisir, in a number of cases, complementary experience from other projects is included.

Preliminary Appraisal and Site Selection

Chapter 2 describes relatively rapid appraisal techniques that can be applied to obtain a cursory overview of human resource use in the coastal zone of the target region. It then illustrates how to use this information in the site-selection process.

Baseline Assessment and Problem Identification

Once CB-CRM sites have been selected on the basis of data provided by the preliminary rapid appraisal, it is necessary to obtain more detailed baseline information from target communities. Chapter 3 describes techniques for establishing a baseline for identifying coastal resource management issues, evaluating project impact, and testing aspects of the project's logic (did project interventions have the hypothesized effect?).

Monitoring and Evaluation

Following implementation of CB-CRM activities, it is necessary to evaluate their impact on project communities. Chapter 4 provides examples of how to design continuing monitoring programs once a baseline is in place. These monitoring programs are designed to provide a methodology for producing CB-CRM project report cards (Harwell et al. 1999), and tracking impacts of various project activities. Finally, this section describes systematic qualitative and quantitative statistical techniques for determining a project's impacts on the human component of the coastal ecosystem during the final phase of the project or at some time after it has been completed. Once again, it is assumed that parallel evaluations will be made concerning biophysical conditions.

In effect, this manual outlines a methodology for testing experiments in CB-CRM. The authors hope that application of those methods can make significant contributions to advancing the state-of-the-art in CB-CRM. Ultimately, they hope that by providing solid supporting evidence that certain interventions achieve their intended impact, while others do not, successful CB-CRM approaches will be widely adopted, increasing the likelihood that subsequent investments in community-based coastal resource management will reap higher dividends.

2

PRELIMINARY APPRAISAL AND SITE SELECTION

2.1 INTRODUCTION

Effective CB-CRM project design is highly dependent on accurate and timely information concerning the distribution of habitats, people, and coastal activities throughout the target region. Frequently, available information is old, incomplete or unreliable. The purpose of this chapter is to provide a methodology designed to generate information essential for the early stages of project design and site selection.

Of primary importance is adequate sampling of the diversity of communities and habitats included in the region. Once the sample is selected, relevant information must be compiled for each sampling unit. This chapter outlines a sampling methodology, the types of information required and methods for its acquisition, including the composition of the field team, preliminary preparations, transportation and accommodations, procedures for data acquisition, and validation techniques. It provides a detailed example of a preliminary appraisal that can be used as a model for preparing reports. Finally, it discusses using the appraisal as part of the site selection process.

2.2 SAMPLING

For purposes of this manual, it is assumed that a decision has been made to use CB-CRM as a technique, either alone or in combination with other techniques, to manage the coastal resources of a defined region (large bay, province, etc.) where a few communities will be selected to develop pilot projects. Frequently, the target region includes hundreds of communities located in the numerous ecological niches or habitats that characterize many coastlines (for example, islands, lagoons, swamps, river mouths, sandy beaches, rocky shorelines). The communities usually vary in terms of relative emphasis on different productive activities (farming, fishing, industry, tourism, etc.) and even vary with regard to specific activities within these gross categories. For example, communities characterized as fishing communities usually vary with respect to target species and methods used. Faced with all this variability and the typical need to select a few communities for pilot projects, it is necessary to somehow describe the range of variation and select communities representative

of various points within this range. This is essential to maximize the chances that the lessons learned in the pilot communities are applicable to the widest range of communities in the target region.

An accurate description of the range of variation in the target region depends in large part on the communities selected to provide data for the analysis. This is a sampling problem, and as with all sampling problems, it is usually constrained by time and money. Ideally, if the sampling universe were large enough (hundreds or thousands of communities) and the budget and time constraints were generous, a simple random sampling technique could be used to select a sample of around 100 communities—the exact sample size being based on appropriate application of some type of statistical power analysis (Cohen 1988). Also ideally, if the sampling universe were small enough (less than 30) and the budget and time allowance large enough, all the communities could be surveyed. Reality, however, often includes rather severe time and budget constraints, often of such magnitude as to rule out even stratified random sampling, resulting in the need to use some form of purposive, representative sampling to achieve a minimally acceptable profile of the target region. Since many good books have been written dealing with the topics of simple random and stratified random sampling techniques (Hedayat and Sinha 1991, Henry 1990, Rosander 1977), the purposive, representative technique, under severe budget and time constraints will be described here. Variables used to make the sample representative are similar to those that would be used to stratify a simple random sample.

Purposive, Representative Sampling

Purposive, representative sampling is a technique used when financial and time constraints prohibit a statistically acceptable sampling procedure. As long as its limitations are understood, it is the minimally acceptable method for characterizing the variation in a region of coastal communities for purposes of selecting representative sites for pilot CB-CRM projects. The limitations are as follows:

1. Results cannot be used to estimate population (regional) parameters. For example, if 20 percent of the sample sites manifest a certain characteristic, we cannot claim that 20 percent (with error estimates) of the communities in the region manifest this characteristic.
2. The smaller the sample, the more likely significant variation in the sampling universe will be missed.

Given these caveats, the purposive, representative sampling procedure should begin with a determination of maximum possible sample size, which is determined by available time and funds, along with an estimate of the time required to collect data and average travel time between sites. Ideally, application of these parameters will result in a projected sample size somewhere between 20 and 40, which should be sufficient to provide a minimally acceptable characterization of the coastal communities in the target region.

Procedure

The steps or procedure for selecting a sample of villages to be surveyed for a rapid appraisal of a region are summarized below:

1. Determine time and financial constraints.
2. Using people knowledgeable of the area and available maps (preferably recent, detailed topographic charts and aerial charts), estimate travel time for various distances between coastal communities using various available means of transportation (boat, motorcycle, automobile, bus).
3. With knowledge of available time and estimated travel time, and assuming on-site data collection time to be a minimum of 24 hours, calculate maximum sample size and subtract 20 percent to allow for unexpected problems (for example, engine failure, severe storms).
4. Compile available secondary information on coastal communities and areas. This should include reports and statistics from regional and national statistics offices; fishery, agriculture, and forestry offices; as well as the most recent detailed topographic, bathymetric, and aerial charts available. Legislation applicable to the area should also be collected, since it may indicate sanctuaries, closed areas, etc. Also, if available, interview knowledgeable local experts (university researchers, fishery agents, and private businessmen residing in the city who conduct business in the coastal communities).
5. Examine available information and select criteria for sample selection based on what is available (population; percent fishers; fishing gear types; coastal characteristics, such as percent mangrove cover, presence of coral reefs, river mouth, island or mainland, rocky or sandy coastline, etc.; and geographic distribution).
6. Select sites based on these criteria.

If the results of the above procedure indicate a sample size less than 20, either adjust available resources to increase sample size or accept the fact that the limitations noted above will apply more severely and reduce the reliability of the assessment to a level that may be unacceptable.

Example 1: Sample selection procedure

The following sample selection procedure was carried out in the initial phase of the Coastal Resources Management Project (Proyek Pesisir) in North Sulawesi. It was decided that the region to be covered would be Minahasa Regency and that metropolitan centers would not be targeted in the first phase. The Regency of Minahasa is about 4,168 square kilometers with a population of 734,223 at the end of 1995 (Kantor Statistik Kabupaten Minahasa 1996). Length of coastline (excluding offshore islands) is roughly estimated to be 350 kilometers. There are approximately 110 villages along this coastline, excluding the metropolitan areas of Manado and Bitung.

Maximum time available for the appraisal was 30 days, including several days debriefing in project headquarters following the completion of the first five or so communities. Examination of topographic charts indicated that much of the area around the north coast and along the Maluku Sea coast would be difficult to access by automobile, and the islands off the north coast would require use of a boat; thus, it was decided that a boat would be the appropriate means of transportation. Given the length of coastline, estimated boat travel time, and the need to spend approximately 24 hours in each community, it seemed reasonable to expect to finish an appraisal of at least 20 communities in 30 days.

A preliminary sample of communities and groups of communities was selected on the basis of official statistics concerning population, number of fishers in relation to farmers, and geographical position. Every effort was made to select communities reflecting the range of fisher/farmer ratios, total population sizes, and location along the coast and offshore islands. Because of missing data in the statistics for some of the Maluku Sea coastal communities, several kecamatan (larger political divisions composed of a number of communities) were selected with the final decision to be made in the field. This preliminary sample included 17 specific villages and four Maluku Sea coast kecamatan from which specific villages would be selected during the assessment.

Communities included in the final sample are indicated in Figure 1. As an example of the types of problems that can disrupt the best planned schedule, heavy seas prohibited use of the boat during the initial stage of the assessment, so the seven sites along the coast from Tanamon to Tambala were assessed using an automobile for transportation between villages. Fortunately a good road exists along this stretch of coastline.

Figure 1: Location of sample sites

2.3 INFORMATION NEEDS AND METHODS FOR PRELIMINARY APPRAISAL

It is important to realize that most projects allow very little time for this type of preliminary appraisal. The amount of time necessary for this important process is frequently underestimated, often due to the mistaken belief that available secondary information can be used to supply most of the necessary information. The limitations of available secondary information are as follows:

1. Available statistics are frequently five to 10 years out of date, an unacceptable problem in a period of rapid change.
2. Information concerning important variables (for example, number of fishers, types of coastal and marine activities) is frequently inadequate, sparse or unavailable.
3. It is frequently hard to assess the reliability and validity of the information.

Use of Secondary Information

The second point above is very important and will be discussed in detail, since it involves one of the most important data points concerning coastal zone use. The number of fishers is frequently underestimated in census material, since the number reported almost always refers to full-time fishers. It is not unusual to walk the beach of a village and count two to three times as many boats as the number of fishers reported in official statistics. When boat owners are questioned, they say, "Yes, I am a farmer, but when I am not working in the field, or when there are many fish, I go fishing." Household occupational multiplicity characterizes many rural coastal communities. In three out of four coastal communities where the authors recently conducted surveys, more than half the households practiced four or more productive activities (Pollnac et al. 1998). Many of these activities are significant for coastal resources management (fishing, seaweed farming, fish farming, fish processing and marketing, mangrove harvesting, coral mining). Nevertheless, they do not reliably appear in any published statistics. The sparseness or absence of data concerning fishery activities is often due to fishery offices' having limited resources for conducting surveys. Hence, villages in the samples are usually widespread, and the frequency of complete surveys is too low for the needs of the type of preliminary assessment necessary for CB-CRM development.

Despite these caveats concerning the use of secondary information, all available information should be acquired, evaluated and used in combination with the field research methods described below. The published data can be used to establish trends and provide the appraisal team with expectations that can be further investigated. For example, an activity reported in published material that is no longer occurring may lead to questions uncovering the demise of a resource. Similarly, an activity not reported in published literature, but present, can lead to the discovery of reasons for changes in coastal activities. Hence, despite the problems with secondary information, it has its uses. It should not, however, be relied upon as the sole source of reliable information for preliminary assessments.

Available secondary information (for example charts, reports, statistics, legislation) should be collected as a part of the procedure for sample selection. Once the sample has been selected, cull secondary information on sample communities for all information relevant to the preliminary appraisal.

Information Requirements

As inadequate time is usually allocated for the preliminary appraisal, it is important to specify a minimal data set that will provide a description of coastal activities and conditions sufficient for a superficial sketch of general conditions in the target area. Hence, there should be a clear rationale for every variable specified.

Population, distribution of population and population density are clearly related to coastal ecosystem health. They influence both pollution and intensity of resource exploitation. Productive activities (fishing, farming, coral mining, mangrove cutting, etc.) are directly related to coastal ecosystem health, and the occupations associated with these activities form an important aspect of community social organization. Discovering the existence of potentially destructive practices associated with productive activities is especially important. Different relationships between the people and the natural resource are often reflected in, and influenced by, community social groupings (organizations, ethnic and religious groups). They need to be accounted for in a preliminary appraisal for coastal resources management purposes. Community infrastructure (roads, schools, medical care, markets, transportation) has direct links to many aspects of the coastal ecosystem, especially the economic value of coastal products and the quality of life of the human population.

It is also important to determine major issues, such as perceived changes over the past five years in the overall well-being of the community, the condition of the fishery and the condition of other coastal resources exploited. Reports on these important issues by key members of the community provide information which otherwise may be impossible to discern in a brief visit. Finally, a general description of the coastal geography is necessary, including outstanding oceanographic conditions (for example, destructive currents or wave action); ocean depth nearshore; a minimal description of coral reefs, distribution of mangrove, beach characteristics (including litter and erosion), and locations of rivers, streams and swamps. Information on coastal geography will facilitate understanding the existing relationships between the local population and their environment, and may also indicate potential problem areas. The foregoing represents the minimum essential data needed to provide an initial understanding of coastal management issues for a given target area.

Specification of Variables

The following provides a more detailed description of the variables generally described above, which are to be assessed as a part of the preliminary assessment.

1. Coastal Zone Physical Geography Prepare a general description of terrestrial terrain (for example, slope, land use); general coastal configuration and condition (bay, river, swamp, mangrove locations, estimates of size, shapes, etc.); composition (sand, pebbles, rocks, etc.), and extent of erosion, litter and runoff; nearshore bottom characteristics (slope, presence and general condition of coral); and any salient climatic or oceanographic conditions that influence human behavior (for example, strong currents, large waves, seasonal storms).
2. Population Obtain present population of the community and population from the next previous census. This will permit evaluation of recent population trends.
3. Settlement Pattern Describe whether houses and other structures are concentrated (nucleated) in one area along the coast, dispersed, or in some combination (nucleated coastal and dispersed inland).
4. Land Area and Suitability for Agriculture
5. Occupations Find percent of population engaged in various occupations.
6. Coastal Activities Identify all coastal zone activities; for each, identify target resource, methods and gear types (numbers of gear); who is involved, when, where, why (home consumption, market); and method of marketing and distribution. For tourism, identify types (for example, sport fishing, sun bathing, diving) and facilities (number of dive shops, hotel rooms, beach facilities, etc.).
7. Community Infrastructure Determine numbers of hospitals, medical clinics, resident doctors, resident dentists, secondary schools, primary schools, telephones, food markets, hotels or inns, restaurants, gas stations, banks, percent of homes with water piped to them, sewer pipes or canals, sewage treatment facilities, septic/settling tanks, electric service hook-ups, public transportation and paved roads.
8. Social Groups Find percent distribution of both ethnic and religious groups, names of all organizations identified by type, function, year formed and membership.
9. Major Issues Identify perceived changes over the past five years in a) overall well-being of the community, b) condition of the fishery and c) condition of other coastal resources exploited.
10. Destructive and Illegal Practices Determine presence of destructive techniques like use of poisons or dynamite, use of scare lines over coral reefs, anchoring on reefs, and/or pollution of waters etc.

Data Gathering Methods

Since the amount of time allocated for each community during such a survey will be minimal (one to two days), it is important to specify desired characteristics of field workers, preliminary preparations necessary, transportation and accommodations, and limitations of the data.

The Field Team

The field team should be small (no more than three or four, including boatman or driver) to facilitate rapid movement and accommodations logistics, as well as to minimize disruptive effects in small coastal communities. At least one member of the team should be fluent in the local dialect of the language. The scientists (social and/or biological) should have broad experience in coastal communities with extensive knowledge of traditional and modern coastal resource productive activities; they should be able to recognize most fishing gear and identify organisms with the aid of a guidebook. They should be in good physical condition, able to walk tens of kilometers a day, day after day, in the prevailing local weather conditions. They should be sufficiently adaptable to go to sea with local fishers to observe fishing techniques, if necessary, and at least one should be able to use snorkel gear to observe the general condition of coral reefs, if present. Ideally, one would be a social scientist with extensive experience in small-scale and industrial fishing communities, and the other a marine biologist.

Preliminary Preparations

All secondary information available should be reviewed and the required data abstracted for communities in the sample. Charts should be carefully scrutinized and preliminary travel plans developed, maintaining flexibility, since field conditions may be better or worse than those depicted on the charts. If available, local terminology for coastal resources (flora, fauna, mineral) and gear and techniques should be compiled. This will facilitate data acquisition, as noted by a social anthropologist with extensive experience in coastal communities,

> … furnished with the right word, one can get a direct answer to a question or understand a situation at once; without it, however correct one's speech may be grammatically, one may often puzzle one's informant or be reduced to giving and receiving laborious explanations which often irritate the person one is talking to. (Firth 1966:358)

If local taxonomies are not available, extra time should be allocated for the first site or a special trip should be made to a community in the region to compile preliminary taxonomies. A preliminary taxonomy should include most important species and types of gear. This can be supplemented as the data collection procedure goes forward.

If necessary, permission for travel through the area should be obtained. Also, if necessary, letters explaining the purpose of the exercise should be sent in advance to local community heads, so that they can be prepared for the team's arrival.

Transportation and Accommodations

The ideal way to conduct this type of assessment is by boat. Access to marine sites is facilitated, poor coastal road conditions (or lack of road) are irrelevant, and if the boat is large enough, the accommodations problem is avoided. One of the authors of this manual conducted a similar assessment recently using a nine-by-two meter boat

with a small, open cabin (see Example 1). The cabin was extended with a wooden framework and a tarp, and the team (human ecologist, marine biologist, boat driver and helper) slept on the boat, just offshore from the communities in the sample, providing round-the-clock observation of coastal activities.

If transportation is by land, planning should account for the fact that many coastal communities are difficult to reach. The map may show a road connected to the coastal community, but roads along the coast are frequently in poor condition, and the community center may be several extremely rough kilometers away from the coastline and coastal residents. Sometimes the coast cannot be accessed by motor vehicle at all, necessitating a time-consuming hike through terrain containing little information of use to the preliminary assessment.

If it is necessary to arrange accommodations, all attempts should be made to stay in the sample community, despite the fact that most small rural coastal communities do not have hotels or inns. In this type of survey, time is of the essence, and time spent traveling back and forth to an inn or hotel in another community is wasted. It is usually possible to find someone in the sample community who has a spare room. This might involve sleeping on the floor, so be prepared. Accommodation in the sample community provides extra time, while eating and settling in for the night, to acquire information that might otherwise have been missed in the brief time allocated for the assessment.

Limitations of the Data

It is important to note that the limited time spent in each village places constraints on the process of verifying information acquired by interview. In many cases, it is possible to make observations that can be used to validate certain types of information. For example, if told that a certain type of resource use is carried out at night, attempts should be made to observe the practice; if told that no mangrove were harvested recently, the mangrove area should be examined, etc. Observed numbers of boats, by type, can be used to validate statements about the approximate number of fishers, etc. Some productive equipment, however, is small enough to be kept in the household or other closed storage place; hence, it is necessary to rely on information provided by several informants (for example local fishers, fish buyers).

One problem with making observations (and conducting interviews) concerning natural resource use, however, is that it is periodic (fishing seasons or times) and often conducted in difficult to access areas (on the far side of an offshore island). Use of a boat facilitates assessment of a wide range of areas not readily evaluated from land. Nevertheless, the periodicity of activities can have an influence on what informants tell you (they are more likely to respond with information concerning current activities), as well as the scope of one's own observations. For example, interviews concerning milkfish fry capture would never provide the insights provided by observation of the

activity (see description in Example 3). This is a great weakness of rapid assessment techniques, especially with respect to coastal activities.

With these caveats in mind, it is nevertheless felt that if the information is derived from interviews with several informants, combined with observation where possible, it does present a relatively reliable snapshot of practices of coastal resources management, relevant activities and conditions in the sample communities. It should, however, be used only as a preliminary overview, to stimulate further investigation for deriving information on which coastal management efforts can be based.

Procedures for Data Acquisition

Suggestions of procedures to be used for data acquisition are presented below for each of the specific variables discussed above. Alternative methods are suggested where appropriate, and estimates of reliability and potential pitfalls accompany many of the suggested methods.

COASTAL ZONE PHYSICAL GEOGRAPHY A preliminary assessment of the physical geography of the coastal zone can be accomplished with the use of available topographic, bathymetric, and aerial photos and maps. Interviews with community officials and other key informants (fishers) can be used to supplement information available in the published material and charts. This preliminary description can be further supplemented and verified by observations made while walking the community and the beach, and snorkeling in the nearshore waters. While in the community (and while sailing along the coastline, if a boat is used), photographs should be taken to supplement the written report and jog one's memory during report preparation. If the field worker cannot identify soils, etc., samples and photographs can be taken to experts for identification, as necessary. The data needed is a general description of terrestrial terrain (for example, slope, land use); general coastal configuration and condition (bay, river, swamp, and mangrove locations, estimates of size, shapes, etc.); composition (for example, sand, pebbles, rocks); extent of erosion, litter and runoff; near shore bottom characteristics (slope, presence and general condition of coral, etc.); and any salient oceanographic conditions that influence human behavior, such as strong currents or large waves.

POPULATION Population can usually be obtained from published statistics, though these are frequently out of date; if available, current population figures should be obtained from community officials. The published figures can be used for earlier periods to establish trends. It may also be useful to obtain earlier figures from community officials as well, as a reliability check. In some countries, however, it is difficult to obtain data at the village level—it is sometimes aggregated at the next higher level. Such is the case in the Philippines, where Provincial Profiles include data for the municipality, but not the barangay (village). In almost all cases, village officials keep records that can be used. If earlier population figures are much higher or lower than expected,

probe for an explanation. Sometimes two villages will merge into one, or one grows to the extent that it is split into two. Without this information, one might report inaccurate population trends.

SETTLEMENT PATTERN There are several sources of information for settlement patterns. First, in some cases, the community is required to prepare a map indicating land use. Many times, especially in smaller communities, these maps will indicate separate structures and can be used to determine settlement patterns. Second, unless there is dense tree cover in the community, recent aerial photographs, if available, can be used to determine settlement patterns. Recent topographic maps, if of appropriate scale, also indicate distribution of structures. In all cases, however, it is desirable to take a quick walk through the community as a means of validation. The walk-through will form part of other data validation and collection procedures as well, justifying the time it takes.

LAND AREA AND SUITABILITY FOR AGRICULTURE Published statistics frequently include information on land area and amount suitable for agriculture. The community map mentioned with regard to settlement patterns may also be useful. These land figures are also maintained by community officials in many countries; additional information may be derived from aerial photos.

OCCUPATIONS In some countries the percent distribution of different occupational subgroups can be obtained from published statistics. Often, however, the data is aggregated at a higher level than the level of the community being assessed. In most cases, community officials keep statistics concerning percent distribution into different occupational categories, which can be obtained easily. No matter what the source, one must keep in mind that these figures, both from community officials and published statistics, usually refer only to full-time participants. Hence, significant numbers of part-time participants may be overlooked. Enumeration of boats and gear, discussed as a part of obtaining data on coastal activities, may serve at least partially to correct for this type of error. For example, if available information indicates that there are five fishing families in the village, but observation indicates 30 boats rigged for fishing, additional questions to clear up the discrepancy are clearly needed.

COASTAL ACTIVITIES Obtaining accurate data on coastal activities is not an easy undertaking. They are usually seasonal, many take place out of sight of land, and activities take place at all hours of the night and day. Since this is one of the most important types of data collected in the assessment, a multi-method approach is advisable. Since this is also the most complex type of information to be collected in the assessment phase, it is detailed in the sections below.

Preliminary preparation—As noted above, if time permits, preliminary preparation of a taxonomy of coastal activities, target species, boats and gear will greatly facilitate the acquisition of accurate information on coastal activities. The most effective way to prepare a preliminary taxonomy is to visit a community in the target region and spend

several days walking the waterfront, observing coastal activities such as fish landings, coral mining, mangrove harvesting, etc. At the same time, ask for the names of every activity, its associated equipment (boats, gear) and every coastal resource observed. Pay attention to minor variations between boat and gear types. The differences may signify not only a different type of vessel or gear (which will probably have a different name), but also different fishing methods and target species.

Walking around asking questions is a good technique for identifying knowledgeable individuals who are willing to provide useful information. Keep in mind, however, that coastal activities are carried out at all times of the day and night, and the timing of the data gathering could result in bias if all times are not covered. Most producers like to talk about their activities to someone who is sincerely interested and also knowledgeable. Be prepared to answer questions concerning methods you have seen elsewhere as well as to make comments about similar techniques, where appropriate. Such comments stimulate informants to provide even more detailed information in hopes of learning something from the interviewer.

A technique found to be useful for stimulating interest where fishing is a major activity is the use of a good fish identification guide, with colored pictures. Fishermen love to look at fish and talk about them. The process usually draws a small crowd—fishers, fish sellers and children—who will provide the local names of fish, as well as names for the techniques used to capture them. These taxonomies will not be simple. This is especially true for multi-species tropical fisheries where local taxonomies will name several hundred species (Pollnac 1998). Within the community there will also be some variation with respect to names. Fish sellers sometimes use more general terms (shark, rather than nurse shark) or a lingua franca (Indonesian, the national language of Indonesia, instead of Javanese, the language used by many Javanese). Coral reef fishers will tend to have more elaborate taxonomies of reef fish, while pelagic fishers may know fewer reef species. If the coastline is characterized by recent or past immigration from different areas, names may vary according to area of origin. Names should be cross-checked with several informants. If several names are provided for the same species, simply note that there are alternate names—a common finding. Photographs of any species one is unable to identify in the field can be brought to specialists for identification later. Warning: do not assume that the preliminary taxonomy of boats, gear and aquatic resources is complete. The degree of completion will depend on time and effort used in its preparation, as well as the degree of local and inter-community variation.

Assessment—Assessment of coastal activities usually starts during interviews with community officials. In the initial interviews, it might be productive to inquire about the presence of different types of coastal activities. A checklist (prepared as part of the preliminary preparation described above), including known and anticipated coastal activities for the target region could be used as a guide for these interviews. If an official

appears to be well informed, try to obtain percent distribution (or numbers) of different activities, gear types used, principal species targeted or cultivated, participants (according to sex and age), seasonality, and distribution and marketing.

Resource use information obtained during initial interviews with community officials should be verified by other sources of information, such as the enumeration and observations made during a walk through the community and along the coastline. General informational walks can be conducted at any time. Frequently, the most appropriate time is following the initial interview with community officials. Ask one of the officials if he has time to accompany you to the coastline. This act would show that the walk has been sanctioned by a higher authority. Observations of coastal activities can begin at this time, but the enumeration walk for fisheries activities should be done when most boats are at the shore, during non-fishing times. When walking the coastline, nothing should be overlooked—all unnatural looking (for example, apparently manmade) structures and objects along the beach, in the water, in the boats, etc. should be identified. One needs to develop the curiosity of a child, to learn to see again. Piles of coral, or coral in roadbeds or house foundations, are evidence of coral mining and should be investigated. Similarly, stacks of recently cut poles, logs for boats, and poles used in construction of gear or buildings suggest harvesting of forest resources. Buoys in the water are usually attached to something and poles protruding from the sea must have some function—ask what they are used for. Instances of coastal management field workers missing a several-hectare fish weir that looked like a stone wall in the sea have been observed. The field workers stated that they saw it, but never inquired about it. If a large fish weir can be overlooked, what about a small fish trap alongside a fisher's dwelling?

For each coastal activity identified, as much of the following information as possible should be obtained from key informants:

- Number of people involved and their status (male, female, young, old, local, outsider)
- When (time of year, month, moon, tide, day)
- Where (where does the activity take place, what are the use rights)
- How much (what is the average harvest per boat or individual; what is the area and production of aquaculture ponds, etc.)
- Why is the resource harvested? For home consumption or for the market (local or non-local)
- How is the resource gathered in terms of equipment and methods?

Fishing is perhaps the most complex coastal activity in terms of diversity of targets, methods, locations and uses, so some detail will be provided for obtaining information concerning this important coastal activity. This is provided as an example of methods and techniques for rapid field appraisal.

Boats and gear types should be enumerated using local nomenclature, either the preliminary taxonomy discussed above or one generated during the beach walk. Types of boats and gear should be queried until field workers are sure of the names. Small differences in hull shape, outrigger configuration or size may signify a different type of vessel, which may be related to a specific fishing technique. Likewise, minor differences in gear or deployment of gear are related to target species and potentially destructive techniques. For example, a gillnet suspended in the water column and fished passively has different potential impact on coral reefs than one which is fished by scaring the fish into the net with scare lines or poles dropped onto the coral. Motorized vessels can usually be distinguished from non-motorized by the presence or absence of a motor mounting.

Enumeration of boats is usually facilitated by the fact that boats are usually kept on the beach side of dwellings or moored in the water. Nevertheless, the field worker must investigate the land side of dwellings as well. (In one area of the Philippines where one of the authors worked, fishers from the hills behind the village kept their small outrigger boats suspended on forked sticks in a boat parking lot on the land side of dwellings along the coast.) In some cases it will be impossible to find a time when all boats are ashore. Try to identify the time when most fishers will not be fishing, then use common sense to try to estimate the number of boats at sea. Ask what types of boats are out at the time of the enumeration, and determine where they fish. If they fish the inshore area, within sight of land, an estimate can be made by counting the boats at sea. If fishers from another community fish in the same area, ask local fishers for an estimate of numbers. Sometimes the number of boats at sea can be estimated by shoreside evidence, mooring buoys, logs used as rollers to bring the boat ashore and upon which the boat is stored while ashore, tracks made in the sand when the boat is pushed to the water, etc.

Gear is more difficult to observe. Large gear types (nets) are often stored in the boat, but this varies from region to region. In areas where fishers are concerned with theft, or if the net can deteriorate when exposed to sunlight for long periods of time, nets may be stored indoors or under tarps. Smaller gear types (small nets, hook and line, spear guns, etc.) are almost always stored in a small shed or adjacent to the fisher's dwelling. Obviously, simple counting of gear types is not possible. Although a simple counting of gear types on the beach would result in unreliable information, observation of stored gear, gear in boats, and deployed gear can be used as a starting point for questions posed to fishers in their dwellings or along the beach. For example, if fishers are observed beating the water with sticks, ask a nearby fisher what they are doing. He will probably respond that they are scaring fish into their net. Then ask, what type of a net? What type of fish? Is there a name for that kind of fishing? What is the work group size associated with the technique and how many groups are there? Are there special times of the year when the technique is used? Are there other ways to use that type of net? If yes, what are the names of the other techniques used to deploy the net? What are the

target species of each named technique? What is the work group size associated with each technique and how many groups are associated with each? What are its seasons?

Another significant observational method, used to identify techniques and species, is to identify landing places and landing times, and to be there to observe landings. Since landings will occur only once, or at most several times, during the brief initial assessment, this technique will suffer from the seasonality problem. Nevertheless, it has the positive aspect derived from the direct observation of behavior. Photographs should be taken of species that the field worker does not recognize for later identification by experts.

A supplemental technique for identifying important species, seasonality and techniques, is to interview fish buyers, who can also provide information concerning quantities entering the market, as well as marketing information discussed below. As noted above, however, fish buyers often use names for fish that differ from those used by the local fishers.

One extremely effective method, which eliminates the timing problem and is useful for both species and technique identification, is to use a book, preferably with colored pictures, as a stimulus. Discussed above as a tool in preparation of a preliminary taxonomy, this technique should be continued throughout the preliminary appraisal. Fishers love to talk about fish and fishing techniques, and a picture book will usually attract a group with copious information on the local taxonomy, as well as on fishing techniques and seasons.

Techniques analogous to those described above for fishing can be used to describe other coastal activities (for example, agriculture, aquaculture, coral mining, mangrove cutting, tourism). Community officials and participants can be interviewed, and observation of activities and their physical evidence can take place.

The distribution and marketing of different target resources should be described (for example, home consumption, local market). Fishers, fish farmers, seaweed farmers, coral miners and others can be asked what is done with the different species (taken home to be used, sold directly to buyers on the beach, taken to a local market to be sold by retail sellers, hawked door to door in the village by the producer or by the producer's wife, etc.). Buyers can be queried concerning where they buy and sell the resource and its ultimate destination (for example, international market, retail market place).

COMMUNITY INFRASTRUCTURE A checklist of the following infrastructure items should be made. Community officials can be queried concerning numbers or extent (e.g., number of miles of paved road), of each item. In many countries, community officials are required to keep records on much of the information included in the checklist. If the information is current, the information can simply be derived from community records. The list should include hospitals, medical clinics, resident doctors, resident dentists, secondary schools, primary schools, water piped to homes, sewer pipes or canals, sewage treatment facilities, septic/settling tanks, electric service hook-ups,

telephones, food markets, hotels or inns, restaurants, gas stations, banks, public transportation and paved roads. Where possible, items on the checklist should be verified during the community walk-through.

SOCIAL GROUPS Percent distribution of ethnic and religious groups can usually be obtained from community officials. Likewise, community officials keep records about formal organizations such as cooperatives and other associations. The officials should be queried concerning the type, function, year formed and membership of each formal organization.

MAJOR ISSUES Several key informants should be interviewed concerning perceived changes over the past five years. First, community officials should be queried concerning the overall well-being of the community. Second, fishers and/or fish dealers should be interviewed concerning the condition of the fishery, and finally, individuals involved in the specific productive activities should be queried about the condition of other coastal resources exploited.

DESTRUCTIVE AND ILLEGAL PRACTICES It is quite difficult to determine the presence or absence of illegal destructive practices like use of poisons or dynamite during a relatively brief preliminary assessment. When asked, community officials and local fishers usually say that they do not do it, and claim that it is done by fishers from elsewhere. An experienced observer can identify blast damage in coral, so if the diver is fortunate enough to snorkel over a damaged area (or if there is sufficient damage) it might be recorded during the brief assessment of bottom characteristics. If blast-fishing is practiced daily, the observer may hear a blast during the minimum 24 hours allotted for each community in the preliminary assessment. Experienced observers can also assess blast damage in the catch (for example, ruptured air bladders and blood vessels, broken bones, mutilated body parts—see Ronquillo 1950). Evidence of material of potential use for blast fishing (for example, bags of urea fertilizer used in bomb construction) may be observed next to houses. If live fish are caught for the aquarium or food trade, cyanide may be used and evidence of squirt bottles or bottles of tablets (possibly cyanide) in boats landing fish suggest the need for further investigation. Destructive practices which are legal (in some cases, these practices are illegal) can usually be readily observed, such as the use of scare lines over coral reefs, anchoring on reefs, or harvesting of mangrove.

Capture of endangered species, both terrestrial and marine, is also difficult to ascertain. The assessment team can bring a checklist and inquire if the species are being captured in the community, but it is difficult to anticipate what species may be captured, and an exceptionally long checklist would be quite time-consuming in a preliminary appraisal. It might be possible to prepare a brief checklist of endangered species by reviewing available literature and interviewing local fisheries experts prior to the assessment. Nevertheless, unless informants are unaware that capture of the species in

question is illegal, it is unlikely that they would admit the practice to an investigator who is conducting a one-day, rapid appraisal. Endangered species may be eaten locally sold whole, either live or dead, for human consumption or only certain products may be sold (bones, teeth, shells, eggs etc.). Look for live holding pens and tethers, evidence of products being prepared for sale (for example, shells, bones, or skins left out drying), and observe items being sold in the local market. Other than that, a little luck and unceasing observation and questioning may unexpectedly uncover capture of illegal species during a preliminary appraisal.

It is important to note that bags of fertilizer, live fish trade, squirt bottles and bottles of tablets do not necessarily indicate illegal methods—they only suggest the need for further investigation. The preliminary assessment is not the time to confront community members concerning illegal practices—the confrontation may adversely affect the community's willingness to cooperate with the project. The observer's role at this point is simply observation and reporting observations to the project for future use or further investigation.

Validation of Information

As noted above in the discussion of data gathering techniques, multiple methods are used for the same data type, wherever possible. The use of multiple methods, as well as multiple key informants, provides cross-validation for information.[1] This is especially important when using outdated or questionable secondary information, as well as when interviewing key informants, including community officials. These informants may be attempting to provide you with accurate answers, but they simply may not know the correct answer or the type of information most useful to the assessment. In other cases, they might not want to provide the correct information. This is particularly true when the response may reflect negatively on them or their community, when they think a slight exaggeration may bring them a new project with funds, or when they think a certain response may please you more than the truth. Selection of appropriate and reliable key informants is not an easy matter, and the time constraints of a preliminary appraisal make it more difficult.

Example 2: The need for cross-validation

This example of the need for cross-validation (triangulation) is based on one of the authors' experiences in using key informants to collect information concerning coastal zone activities in a Caribbean country. It has been derived and modified from Pollnac (1998:178–179). A fisher recommended by marine scientists from a nearby marine laboratory was being used as a key informant for fishing methods and species in a small bay in Jamaica. The marine scientists had very positive interactions with this individual, who was a cooperative, elderly, knowledgeable fisher. While being

[1] Some refer to this process as triangulation.

interviewed by one of the authors, he mentioned a species caught in a beach seine. Beach seines were no longer used in the area and he was asked why. He said fishers no longer used them because they knew that they took everything-small fish and shellfish-harming the resource.

An interviewer with little time and the possibly incorrect perception of the traditional fisher as a conservationist would have probably recorded this information and written it in a report (ideally noting that it was obtained from one, highly recommended fisher, who had a lot of contact with marine laboratory personnel). The interviewer was skeptical, both with regard to the fisher as conservationist and as to the representative nature of a fisher who had extensive contact with marine scientists and came highly recommended. He continued to probe for other possible reasons for the demise of beach seining. After a bit of probing, the fisher noted that there was an economic reason. The owners of beach seines used to be rich men who hired labor to set and pull the net. He said that the fish caught today are so few and small, and worth so little that fishers would no longer hire on as labor for the small amount of income they would receive, hence the discontinued the use of beach seines. This explanation made sense, but interviews with more fishers for cross-validation (ones not recommended by anyone) provided an additional, more compelling factor. The dredging and construction of a harbor used by large bauxite-hauling vessels had deposited scraps of metal and cable on the bottom that snagged the beach seines in the traditional fishing area, an even more compelling reason for the demise of beach seining.

This example was selected because it illustrates several important points. First, a high recommendation does not necessarily mean that the informant will be reliable for your purposes. In this case the informant had a great deal of interaction with marine scientists who gave him ideas about harmful fishing practices. He probably thought that the interviewer would be impressed by a conservation-oriented explanation for the demise of beach seining. Second, it illustrates the danger, when cross-validating a response, of asking leading questions. For example, the interviewer did not approach other fishers and ask, "Did you quit using the beach seine because it harmed the fishing by catching very small fish and shellfish?" That leading question would probably elicit a yes response. In the above case the interviewer simply asked why beach seining was no longer practiced without making any suggestions. Third, since the informant was a respected, elderly individual, one can only speculate the impact he would have had on opinions expressed in a focus group.

Summary of Information Needs and Methods for Preliminary Appraisal

Table 1 provides a summary of the preliminary appraisal data needs cross-tabulated with methods. This table should be used in combination with the text since it is merely a superficial summary.

Table 1: Cross-tabulation of data gathering techniques and variables

Variable	Secondary Data[a]	Community Officials[b]	Key Informants[c]	Observation[d]
Coastal zone physical geography	x			x
Population	x	x		
Settlement pattern	x	x		x
Land area	x	x		
Arable land area	x	x		
Occupations	x	x	x	x
Coastal activities	x	x	x	x
Community infrastructure	x	x	x	x
Social groups	x	x	x	
Major issues		x	x	
Destructive practices		x	x	x
Illegal practices	x	x	x	x

[a] Secondary data includes published statistics, reports, maps, legislation, etc.

[b] Community officials include mayor, chief, secretary, etc.

[c] Key informants refers to any knowledgeable persons, including those inside and outside the community; government agency personnel who have visited the community, researchers who have worked in the area, community members involved in the activity being investigated, etc.

[d] Observation refers to observations made by the research team. The observations are made during beach walks, the community walk-through, sailing by on a boat, while participating in activities, and at all times while in or near the community. It should be a constant activity.

Example 3: Preliminary appraisal for one community

The following example is derived and modified from an actual preliminary assessment of coastal management issues in North Sulawesi using the methods described above (Pollnac et al. 1997a).

BENTENAN

General geographic description Bentenan is located on a serpentine, white sand beach one degree north of the equator on the Maluku Sea coast of Minahasa. A river runs through the village, exiting to the sea at the southern edge of the population concentration. Wetlands, with mangrove swamp and pools of standing water, back the residences built along the beachfront. Small hills separate the slightly concave beaches that characterize the coastline. South of the residential

area a long stretch of curved beach, backed by brush, small trees, coconut palms and pasture, sweeps some 2.5 km south-southeast to Cape Popaya, a finger-shaped point of land scarcely .5 km from the western tip of Bentenan Island, a teardrop shaped island about .75 km by 1.5 km with its narrow end pointed toward the cape. At this point the coral reefs fringing both the mainland and the island almost meet. Off the north shore of Bentenan Island the reef extends .75 to 1 km to the north. The village also has land on Bentenan Island. Most of the island remains as untouched forest. Kabupaten (Regency) statistics indicate that the village has a total land area of 800 ha, 650 ha classified as suitable for agriculture. The sea floor drops to 100 meters some 3.5 to 4 km offshore of the populated area.

Infrastructure Bentenan has a total of 10 km of roads (6 km asphalt, 2 km stone), and the rest dirt. Public transportation in the forms of microlet (small van) and bus links the community to nearby towns and on to the capital of the kabupaten (Tondano) and Manado, some 100 km and three hours away. Belang, the nearest town with full services (bank, gas stations, markets, government offices), and the seat of the kecamatan (district government) is a little over an hour and 20 km to the south. People and products can be transported by the three pickup trucks, three microlet, six motorcycles, 11 oxcarts and 21 bicycles recorded in the village statistics (Profil 1997a). Water piped from an inland source is available at several standpipes located throughout the community; approximately one-third (34 percent) of the households have septic or settling tanks. Electricity from the national electric company is available in the village, connecting approximately 60 percent of the homes. There are no telephones or gas stations. A small daily market operates in Dusun 3. The only restaurant and accommodations are located at the Bentenan Beach Resort (Pollnac et al. 1997a). There are two primary schools (grades one to six) and one secondary school in the village. Thirteen teachers instruct the 159 primary and 34 secondary school students (Profil 1997a).

Population and social groups Kabupaten statistics indicate a population of 1,205 for 1993. The records of the kepala desa (village head) indicate 293 families at the present time. Bentenan has five areas of population concentration, two along the river which flows through the village to the sea, backing the coastal strip, and three in three slightly concave embayments at the northern part of the village. In terms of ethnicity, the community is somewhat diverse, with 75 percent Minahasa, 20 percent Bolaang Mongondow, and 5 percent Bajo. Christians make up 60 percent of the population, and Moslems 40 percent. Bentenan reportedly had five farmer groups (each with 40 members) and three fisher groups (each with 30 members) established in 1995. Eighteen individuals formed a group in 1996 which operates a little shop selling staple supplies. Reportedly, the community, in cooperation with individuals from Rumbia, Tumbak, Wiow and Tatengesan, is trying to

establish a KUD (village cooperative unit) with a marine focus. The group is still in the formative stages, and is being organized with the help of the owner of the Bentenan Beach Resort (BBR).

Coastal activities The kepala desa classifies 50 percent of the population as farmers, 40 percent as fishers, and divides the rest among government workers (mostly teachers), skilled workers and traders (shopkeepers, fish buyers). Agriculture comes right to the beach in the form of coconut palms, while mariculture and fisheries extend inland as milkfish ponds in the wetlands behind the beach. The beach and coastal waters are teeming with maritime activities. Stretching from the population centers, out and over the fringing reefs and reef flats to Bentenan Island, the coastal waters are densely covered with the multicolored plastic containers used as floats for seaweed culture. The shoreline, all along the populated area, is an unending strip of milkfish fry collectors, evenly spaced 10–15 m apart along the beach. The density of the operations begins to thin out south of the village, as one moves to the tip of Cape Popaya, but does not disappear. Some milkfish fry collectors are even found on the west side of the cape, along the eastern shore of Sompini Bay. During the assessment, 95 milkfish fry nets were counted along Bentenan's beach. Just to the north, and abutting the north edge of the residential area, a long row of thatched picnic/beach shelters front the Bentenan Beach Resort with its snackbar/souvenir shop, seven red-roofed cottages, and its administrative building on the hills behind. Finally, the beach fronting the residential area is lined with fishing vessels, the smaller pulled up on the beach and the larger moored just offshore.

The fishing fleet of Bentenan consists of some 51 pelang without motor, 11 pelang with motor, three londe and four pajeko. Net types deployed include gillnets (soma kalenda, a drift net set at the edge of the seaweed culture areas), seine nets (soma roa and seser), and the mini-purse seine (soma pajeko). The pajeko at Bentenan do not use fish aggregating devices as in most other villages. Instead, a pelang precedes the pajeko to the fishing grounds (about half an hour from the village) and lights a number of pressure lanterns to attract fish. The pajeko follows about half an hour later and nets the fish. The entire operation is reported to take only several hours, from departure to landing.

Hand lining, with hook and line, is conducted from the non-motorized pelang. Spear fishing and use of fish traps is reportedly absent from Bentenan. The gillnet (kalenda) harvests mostly tude (smooth tail trevally), sardine, and uhi (rabbitfish). The seine nets, (soma roa) harvests roa (halfbeak), deho (mackerel) and cakalang (skipjack); the mini-purse seine (soma pajeko) catches malalugis (scad), deho (mackerel), tude, cakalang, and the seser, milkfish fry. Finally, hook and line fishing harvests mostly tude and malalugis (scad).

Seaweed are dried and sold to a buyer from Manado for eventual distribution in the international marketplace. Milkfish fry are also sold to a buyer from Manado for resale as far away as Java. Fish are sold to tibo-tibo who resell them locally or to markets in Ratahan, Langowan, Tondano or Tomohon.

Coastal management issues Coral mining exists, as evidenced in construction, and dynamite fishing was reported during the assessment. It was blamed on fishers from elsewhere. One tethered hawksbill turtle was observed along the beach, evidence of retention of endangered species. Fishing with poisons is not practiced. It was reported for the past, but is not used today. Nevertheless, the reef condition at Bentenan was classified as medium (medium coverage and a medium number of species) based on a brief dive. Only a low amount of debris was present on the beach, which showed minimal evidence of erosion.

Mangrove has been cut for the usual construction purposes, but it is also used for seaweed culture stakes. Some was also cleared to build the fish ponds behind the Bentenan Beach Resort and the village. The ponds behind the village, constructed in 1995, have been abandoned and remain as stagnant pools of water.

Although the Bentenan Beach Resort has little business at the present time, it does rent snorkeling gear and take tourists out to view the coral. The seven cottages have a total of only 14 twin beds, so large numbers of tourists are not a problem at the present time. The resort does, however, provide facilities for day visitors, and large numbers come for short, one-day activities. Additionally, some resort staff mentioned that there are plans for a large hotel on the tip of Cape Popaya. Since the area is beautiful, there is the potential that tourism might develop rapidly after transportation links with the airport and Manado improve. This development should be closely monitored.

Impinging on fish populations, the milkfish fry nets, with their tiny mesh, capture all sorts of organisms. Early stages of shrimp, cuttlefish, and other fish are being captured along with the milkfish fry. At the present time they are discarded on the sand, lost forever. Additionally, as in the other communities, the relatively small mesh used in the gill nets indiscriminately captures all sizes of fish, potentially depleting fish stocks by capturing them before they can mature and reproduce. This will become more important as fishing pressure increases with growing populations and markets.

Seaweed prices, being dependent on world markets, may fall as the number of growers increases, as they did in the 1980s (ARD 1996a), leading producers to abandon the practice. Seaweed culture failed in Gangga Satu Village due to other factors, and the farmers simply left the poles, lines, and floats in the water. Much of this plastic debris is now entwined in the coral reef off the coast of Gangga Island, with unknown future impact. If seaweed culture fails in Bentenan, the massive

amount of material, if abandoned, would have unknown, but probably detrimental impacts on the aquatic environment. Additionally, it is not clear what impact the practice has on ecosystem health. Fishers in Bentenan state that rabbitfish have increased in size and number since massive amounts of seaweed were cultivated, but it is not clear what this means with respect to the many other species that inhabit the waters of this complex area.

Although Example 3 gives an acceptable sketch of Bentenan, it suffers from many of the problems that plague overly rapid appraisals. For example, the minimal amount of time allocated to each community made it impossible to estimate the numbers of the various gear types present in a community with as many fishers and as many techniques as Bentenan. Gear left on the beach, such as the milkfish fry nets, could easily be counted, but even the accuracy of that count could be compromised by a few fishers having taken nets home for repair. Further, the milkfish fry fishery would have been very difficult to assess accurately, if not for the fact that Bentenan was visited during the proper time of the month (full moon) during the milkfish fry season. When one of the authors returned to Bentenan three months later, there were only a few milkfish fry nets visible on the beach and only three or four fishers still collecting fry at the very end of the season.

Another example of how fishing season and time of assessment can impact the appraisal is illustrated by the statement that the fishers of Bentenan do not deploy fish aggregating devices (FADs). During the assessment we asked whether the mini-purse seine fishers of Bentenan deployed FADs. The response was no. During the more extensive baseline that was conducted in Bentenan we found that during another time of the year, a number of fishers from Bentenan reportedly deployed approximately 30 FADs in its waters, which are used by mini-purse seine fishers from communities all along the Maluku Sea coast of Minahasa (Pollnac et al. 1997b). These FADs take advantage of schooling fish populations, reportedly spawning at the time, that begin concentrating off the coast of Bentenan in August. This significant fact was completely missed during the rapid appraisal.

Other inaccuracies include data as seemingly simple to acquire as information concerning infrastructure. The preliminary appraisal indicated that 60 percent of homes have electric service. The survey conducted as a part of the baseline indicated 76 percent. This difference was too large to have resulted from sampling error, and it was discovered that while there are 60 percent of the households officially connected (the figure in the official statistics), others connect unofficially by plugging into a neighbor's official connection (Pollnac et al. 1997b).

Observation of capture and retention of endangered species can be extremely difficult during a brief, preliminary appraisal. Such activities are exceptionally difficult to observe,

especially if the prey is kept in a small cage in the water or tethered along the beach. There are all kinds of line and debris on beaches in many of the communities. Stakes, used for various purposes, are also found in the nearshore waters. The first observation of a turtle was made from a boat in a village north of Bentenan. A head appeared above the water about five meters from shore. It appeared again in about the same place. Then another appeared. We could not figure out why the turtle were staying in the same area with all the activity on the beach. When onshore, a line from a stake was noticed, and the fisher standing nearby was asked what was attached to the line. He proudly stated that he had four turtles which were destined to become food and shells sold in the market. The turtle were captured as bycatch in nets. The observation at Bentenan was made when a boat builder being interviewed took some food to his tethered turtle. Neither of these observations would have been made without constant vigilance and a bit of luck.

Despite these caveats concerning the reliability of some of the preliminary appraisal information, the technique, with its combination of secondary information, field-verified secondary information, and new primary information based on observation and interview of at least several informants for each topic, can provide a relatively reliable preliminary overview of a target region, including coastal resources management issues.

Example 4: Preliminary appraisal summary for a region

This example is derived from the preliminary appraisal conducted in North Sulawesi which was described in Example 1: Sample selection procedure (Pollnac et al. 1997a). The preliminary appraisal consisted of 20 site descriptions similar to the one presented for Bentenan above. The 20 site profiles, summarized to highlight the coastal management issues observed, are abstracted and modified below.

Summary Human adaptation to the coastal environment along the coast of Minahasa is so diverse and rapid, that in some cases, secondary information is outdated, even that collected the previous year. Part of this diversity can be related to the biogeographic diversity of North Sulawesi (Whitten et al. 1987) and part to rapid change, proceeding unevenly in the area. Within this broad range of human and environmental diversity, the assessment identified eleven distinct, but interrelated issues. Each of these issues is detailed in separate sections below and their interrelationships examined.

- Direct damage to coral reefs caused or potentially caused by fishing activities (fishing with explosives, poisons, or otherwise causing physical damage to corals)
- Direct damage to coral reefs caused or potentially caused by non-fishing activities (coral mining, seaweed culture practices)
- Potential reduction of fish populations through use of non-discriminating fishing gear which capture juveniles of species before they grow and reproduce

- Coastal erosion potentially caused by destruction of mangrove or coral reefs, which serve to buffer the coastline
- Increased runoff and pollution of coastal waters from activities in uplands (agriculture, forestry)
- Capture and non-release of endangered species due to ignorance of laws or lack of alternatives
- Depletion of mangrove and forest trees resulting from construction of gear used in coastal or other uses (house construction, firewood)
- Inadequate waste disposal
- Tourism development
- Deflection of migrating pelagics by fish aggregating devices
- Intervillage diversity in coastal adaptations suggesting a need for diverse approaches to management strategies and regulations

Fishing activities damaging coral reefs It is a widely recognized fact that certain fishing activities can cause harm to coral reefs. Topping the list are the highly destructive fishing activities using either explosives or poisons. Both these types of fishing, when used in coral reefs, cause direct damage to the coral. While this activity was not observed during the assessment, fishing with explosives was reported in the past (six months or more ago) at four villages and currently (within the past six months) at eight. Use of poisons was less widespread. Reported in the past for only five communities, it is currently practiced in only one area. In all cases, it was blamed on fishers from neighboring villages.

There are, however, other fishing techniques potentially harmful to coral. For example, gillnet fishing using the *rarape* technique, where the net is staked into the coral and pieces of coral are used as weights, could damage the living coral as fishers place the stakes and weights. Both the pakapaka technique, where fishers either slap the water with their hands or poles, or get into the water and move around to frighten the fish from the reefs into the gillnet; and the *cang* technique, where a bagnet is lowered near a reef and a diver with a compressor uses a line with palm fronds to frighten fish from the coral into the net, are potentially destructive, especially if the fishers begin to strike the coral to frighten fish into their nets. Another practice associated with nets that could harm the coral is associated with the *soma udang* (lobster net) which is weighted down over openings in the reef where lobsters are suspected of hiding. Pieces of coral are sometimes used as weights, and the placement on the coral, as well as the human activity on the coral may cause some damage. Additionally, the *igi nare* fish trap is placed right on the reef and camouflaged with pieces of coral, once again suggesting the potential for activities damaging to living coral. Finally, at some sites, fish weirs (*sero*) were constructed directly on the reef flat. Placing stakes and other human activity associated with building the structure can damage the coral.

Non-fishing activities that harm coral Coral mining is a non-fishing activity that directly harms coral. As evidenced by its use in various construction activities (roadbeds, house foundations, retaining walls), as well as by piles of mined coral along the beach or beside houses, it was carried out, to some degree, at 19 of the 20 sites in the sample.

The rapid expansion of seaweed farming may also have negative impacts on coral. To appreciate the potential impact of seaweed farming on living coral, it is necessary to understand the extent to which it is carried out at some locations. For example, at Kulu, seaweed farming (rumput laut) is by far the most conspicuous and space-consuming coastal activity. Almost the entire bay (ca. 2 km^2) is festooned with multicolored empty plastic bottles used as floats for seaweed culture. Threading a boat through the maze of seaweed patches is a slow and difficult process, unless one knows the channels. Similar densities are found at Mubene, Bentenan and Tumbak. At the latter two neighboring villages, a huge, almost continuous, patch of seaweed culture covers most of the reef flats and the seagrass beds from the nearshore area out to Bentenan Island.

Since seaweed culture is dependent on world markets, as the number of growers increases, prices may fall as they did in the 1980s (ARD 1996a), leading producers to abandon the practice. When seaweed culture failed in several other villages, farmers simply left their poles, lines and floats in the water. Examination of the coral during the assessment indicated that much of this plastic debris is now entwined in the coral reef off the coast of Gangga, with unknown future impacts. Diving on the coral also indicated that coral was damaged where the stakes were inserted. If seaweed culture fails in villages where it is now intensively practiced, the massive amount of material, if abandoned, would have unknown, but probably deleterious impacts on the coral reefs.

Additionally, it is not clear what impact the practice has on ecosystem health. Fishers in Bentenan claim that rabbitfish have increased in size and number since massive amounts of seaweed culture were begun. Is this an indication of a positive impact? A respected coral reef scientist was consulted, who said that he knows of no research on this issue, but that the seaweed culture activity would obviously change currents, shade the coral, add organics to the water, and induce trampling by farmers, which would also stir up sediments (J. McManus, ICLARM, personal communication). Obviously, these activities should be closely monitored and research concerning these issues initiated. Seaweed culture provides significant additional income in the coastal zone, and should not be thoughtlessly regulated. Nevertheless, it should be possible to require that when terminated, all materials be removed from the sea and disposed of properly.

Reduction of fish populations with use of small mesh nets In all communities visited, the relatively small mesh used in most of the gill nets and seines

is indiscriminately taking all sizes of fish which will potentially deplete the fish stocks by capturing fish before they can mature and reproduce. As fishing pressure increases with growing populations and markets, this problem is probably going to become more severe, as it has in many other countries, as well as in other areas of Indonesia.

Many communities collect milkfish fry using extremely small mesh nets. As with seaweed farming, the intensity of this activity has to be understood to appreciate its potential impact. It is intensively practiced at the time of highest tides (for example, the several days around full and new moon). During assessment, the activity was observed at Atepoki, Bukittinggi, Bentenan and Basaan. A description of the activity, as found in one of the coastal villages, is essential for understanding its potential impact.

At Atepoki, the gently curving beach was lined with milkfish fry nets (*seser*). The nets, approximately 60 cm by 10–15 m, with a line of floats on the upper edge and weights on the lower, are draped on stakes driven into the sand. A small triangular (or oval) dip net also hangs from the stake. When the tide is right, the length of net is extended into the sea, then brought around in a spiraling motion, gradually enclosing a smaller and smaller area, concentrating more and more milkfish fry. The fry are then scooped from the larger net with the dip net and placed in a shallow bowl. The milkfish fry in this bowl are then taken to the shore, where the fisher's companion waits to sort them from the other organisms by scooping the milkfish fry from the larger bowl with a small container and dumping them into another container, usually a plastic bucket. The unwanted catch is then dumped on the sand.

Picture numerous fishers operating these nets, spaced approximately a net length apart along thousands of meters of beach, and the intensity of fishery activity becomes apparent. In the small, similar embayments a kilometer or less to the north and south of Apoteki (Labuan Korakora and Parentek, respectively), the gently curving white beaches are also lined with milkfish fry net operators, engaged in an activity that is found on beaches all along this stretch of coastline. This was evident in the assessments at Bukittinggi, Bentenan and Basaan, further to the southwest. The quantity of organisms filtered from the water is immense. These nets, with their tiny mesh, capture early stages of shrimp, cuttlefish, and other fish along with the milkfish fry. There may be billions of these fry in the inshore area, but the kilometers of net that are straining these waters must have some effect on the subsequent ecology of the area. Though logical, this assertion should be investigated. It would not be difficult for the fishers to walk a few steps to pour the unwanted catch back into the water. At the present time they are lost forever, discarded on the sand.

Coastal erosion and inappropriate shorefront construction Both mangroves and coral reefs serve to buffer coastal areas from erosion by dissipating some of the energy of swells and waves before it reaches the coastline. Coastal erosion

was noted as a problem at many of the villages visited, and in most cases can probably be linked to removal of one of these buffers. For example at Libas, the channel cut through the mangroves for boat access was reportedly enlarged by storms, and now the brief strip of open beach is eroding at a rate of 2 m per year, according to the kepala dusun (sub-village head).

Coastal erosion is to be expected under some natural conditions, but construction in these erosion-prone areas should be avoided. For example, in Kapitu, houses were built in an area where the beach expanded as a result of natural coastal processes. These same natural processes, however, also erode coastlines, and when erosion occurred, houses built in an area of shifting coastline were washed away.

Upland activities influencing runoff and pollution Clearing uplands as a part of agricultural and lumbering activities increases the potential for flooding and runoff, which creates problems in coastal areas. Some types of construction (roads) can also contribute to runoff. For example, at the time of assessment, the beach of Tanamon was deeply (up to .5 m in some places) covered with debris washed down by recent floods in the mountains, most of which have been cleared for agriculture. The debris was largely composed of coconut palm debris (shells, pulverized fronds, trunks), tree trunks and branches, and other vegetation. Drowned mammals and reptiles were also observed along with a mixture of plastic household debris. One family was reportedly washed out to sea. The debris was so thick that it was a struggle to move boats to the water, and the water itself was filled with floating and suspended silt and debris. This is potentially a problem at all sites visited during the assessment, although observed only at a few. Land cleared by logging and for agriculture backed most of the coastal villages, and as the weather became dryer, fires burning off vegetation were observed in the highlands of the islands of Likupang. Areas of slash and burn agriculture were also observed in the mountains backing the coastal villages of Kecamatan Belang. While runoff can smother coral reefs, which need light for growth, and damage other organisms in the coastal waters, at the same time it detracts from the natural beauty of the beaches, reducing their tourist potential.

Capture of endangered and rare species Villagers are apparently unaware of laws concerning the capture of endangered species. Tethered hawksbill turtles were observed at two villages. Underwater, they were not readily observable, but when fishers were asked what the line running into the water was used for, the turtles were proudly displayed, suggesting ignorance of the law. Fishers were not questioned about their knowledge of the law, lest it inhibit their responses on other questions, increasing the difficulty in obtaining essential information.

Coastal activities, gear construction methods and deforestation Along the immediate coastline, mangroves are subject to deforestation from multiple activities, including cutting for firewood, construction (houses, piers), and aquaculture

ponds. It is not frequently recognized, however, that both mangrove and other trees are endangered by some fishing gear construction methods that could be changed. For example, ARD (1996b) reports that between 8.9 and 25 cubic meters of mangrove wood are used in construction of the fixed fishing weirs (*sero*) used in many communities. Mangrove is also frequently used for seaweed culture stakes and other stakes placed in the water (for mooring boats, attaching milkfish fry nets). Bamboo, for example, could be substituted for mangrove in many of these uses.

More difficult to change, however, are traditional boat construction techniques. The dugout method of constructing boat hulls is extremely wasteful of mature standing timber. This technique is used in every coastal village visited for both outriggers and canoes (*londe*, *pelang* and *bolotu*), with some of the larger exceeding six to eight meters in length. Wood removed in carving a dugout hull is wasted. Construction of hulls using planks or plywood is much more conservative, but requires different skills on the part of the boat builder. A cost-benefit analysis, comparing the two techniques under present conditions in Minahasa, has not been conducted. Nevertheless, indicating that change may be resisted, persistence of the dugout technique suggests that it is still economically feasible.

Sanitation and solid waste disposal Coastal areas are polluted by the common practice of using waterways and beaches as garbage dumps. At low tide, on the beach in every village one can observe individuals carrying wrapped bundles of household refuse to the edge of the water to be washed away by the incoming tide. Where else can they throw it? Of course, it is only washed to other beaches and back again, betrayed by the multicolored plastic bits that decorate the debris on the beaches of most Minahasan coastal villages.

Inadequate disposal of human waste adds another pollutant to water supplies and coastal waters. In only one-third of the 18 communities assessed (for which this type of information was available) did 50 percent or more of the households have septic or settlement tanks for human waste. In five of the communities 20 percent or fewer of the households used septic or settling tanks.

Tourism As in most coastal areas, Minahasa's coastline offers considerable potential for tourism. Development has already begun around Manado and other parts of northern Minahasa, with large hotels, golf courses and other resort activities. The marine parks also attract significant numbers of tourists. In many parts of the world, the development of coastal tourism has been accompanied by environmental degradation, to the detriment of the tourist industry, as well as local communities (Thomas 1991). In communities assessed, there was incipient development of tourism in two of the villages (Gangga Satu and Kalinaun), as evidenced by several cottages, though they were rarely occupied. The Bentenan Beach Resort has little business at the present time, but it does rent snorkeling gear and take

tourists out to view the corals. With a total of only 14 twin beds, the seven cottages constitute no problem at the present time. The resort, however, provides facilities for day visitors, and large numbers (reportedly thousands) come for short, day-long activities. Additionally, some resort staff mentioned plans for a large hotel on the tip of Cape Popaya. In such a beautiful area, there exists a potential for rapid tourism development, after improvements to the infrastructure linking it to the airport and Manado. Firm plans for extensive development are reported for Kima Bajo, including construction of a large resort, hotel and casino complex. Reportedly, Kima Bajo and a neighboring village have released 400 ha for resort development. An environmental impact assessment is said to have been completed, and the joint Indonesian-Singaporean project will start after elections in late May 1997. Villagers will be moved back from the beach and compensated, either with a new dwelling or cash. Jobs will be made available, and the fishers, reportedly, will be able to continue to fish the bay and local waters. These developments should be closely monitored.

Deflection of pelagics by fish aggregating devices While some have argued that fish aggregating devices (FADs) can function to take pressure off overfished inshore fishery resources (Pollnac and Poggie 1997), an opposite effect was observed at several of the sites in Minahasa (Tanamon, Kulu and Kima Bajo). Fishers in these communities claim that when Philippine fishers installed FADs in the offshore waters, they deflected traditional migratory paths of pelagics (e.g., tunas) that, at one time could be easily captured in nearshore waters. Although some Indonesian fishers are now installing and using FADs in offshore waters, many local fishers do not have vessels capable of safely fishing these distant waters. This, in consequence, places more stress on inshore fishery resources, such as coral reef fish.

Inter-village diversity and coastal management The 20 village profiles manifest a great degree of intervillage diversity in terms of human adaptations to the coastal environment. Even adjacent villages such as Tumbak and Bentenan manifest differences that could result in grossly different impacts from management efforts. For example, Bentenan has a strong focus on offshore, pelagic fish. This is reflected in the lack of gear focusing on reef fish (fish traps, and the gillnet fishing techniques referred to as pakapaka and rarape). Bentenan also places a great deal of emphasis on milkfish fry collection. In contrast, no milkfish fry collection was observed in Tumbak and the emphasis is on reef fish, using gear not present in Bentenan. While part of this difference is due to environmental differences (the beach in Tumbak appeared to be unsuitable for milkfish fry collection), each community has ready access to both pelagics and reef fish. The fishers of Bentenan say they do not target reef fish because they obtain enough pelagics from their offshore fleet (pajeko and large pelang). Clearly, regulations impacting reef fish, pelagic fish

or milkfish fry collecting would have differential impacts on the two communities. Variation such as this should be investigated, so that impacts of coastal regulations can more accurately be anticipated.

Table 2 illustrates the distribution of many of the coastal management issues across the assessed villages.

Table 2: Distribution of coastal management issues in villages assessed

Village	Issues													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Tanamon	P	–	N	N	–	•	N	H	•	H	–	L	–	55
Blongko	–	–	N	–	–	•	N	L	•	L	–	L	–	30
Kapitu	N	P	N	N	–	•	N	H	•	M	N	L	–	50
Ranoyapo	–	–	N	N	–	•	N	H	•	H	–	–	–	30
Lopana	–	–	N	N	–	•	N	L	•	M	–	L	–	52
Bajo	N	–	N	N	L	•	N	–	•	L	N	M	–	•
Tambala	–	P	N	N	–	•	N	H	•	M	–	L	–	•
Kimabajo	–	P	N	N	–	•	N	–	•	L	–	L	F	15
Kulu	N	N	N	N	H	•	N	–	•	L	N	L	–	60
Mubune	–	–	N	N	H	•	N	L	•	L	N	L	–	10
Gangga I	N	–	N	N	P	•	N	L	•	L	–	L	I	24
Talise	–	–	N	N	P	•	N	H	•	L	–	M	–	30
Libas	–	–	N	N	P	N	N	H	•	L	N	M	–	09
Kalinaun	P	–	N	N	–	N	N	H	•	M	–	M	I	60
Lilang	P	–	N	N	–	•	N	M	•	L	N	L	–	100
Atepoki	P	–	N	N	L,P	N	N	L	N	M	–	L	–	40
Bukittinggi	N	–	N	N	L,P	N	N	L	•	L	–	L	–	05
Bentenan	N	P	–	N	H	N	N	L	N	L	–	L	P,F	34
Tumbak	N	P	N	N	H	–	N	L	•	L	–	L	–	08
Basaan	N	–	N	N	–	N	N	L	•	L	–	L	–	25

Codes: – = Not present; N = Present; • = Not observed

Issues:

01 Bomb-fishing*: N = Now (within past 3 months); P = Past
02 Poison-fishing*: N = Now (within past 3 months) P = Past
03 Other fishing methods potentially harmful to coral
04 Coral mining
05 Seaweed culture: P = Past and debris remains; H = Intense; L = Low
06 Milkfish fry collecting (see Note 1, Section One)
07 Small mesh nets
08 Coastal erosion: L = Low; M = Medium; H = High
09 Capture of endangered species
10 Debris on beach: L = Low; M = Medium; H = High
11 Gear using large amount of mangrove (Weir)
12 Cutting mangrove: L = Low; M = Medium
13 Tourism: F = Firm plans for hotel/resort development; I = Incipient (a few cottages, occupied rarely); P = More than 5 cottages plus other facilities frequently occupied
14 Percent of households with septic or settling tanks

Note: Not observed does not mean that it was absent.

*Based on reported behavior. The reliability of reports of use of poison- and bomb-fishing is not very high.

2.4 PROJECT SITE SELECTION

Information acquired from the preliminary appraisal should be summarized and used in the project design and site selection process. Although it is essential that site selection be based on coastal management issues uncovered in the preliminary assessment, other criteria may be significant for specific purposes. For example, in some cases political considerations will have to be taken into account, and there may be a preference to have a project located in each of several political divisions of the target region. Other considerations may involve the willingness of community officials to become involved, the expected degree of cooperation by community residents, and the existence of community organizational structure (cooperatives or other associations) which may facilitate community participation. These considerations are project-specific, depending on the unique characteristics and needs of each. Thus, the preliminary assessment findings should be used in combination with these other considerations to select the project sites.

Example 5: Project site selection

The project established a Provincial Working Group (PWG), chaired by the Regional Development Planning Board for North Sulawesi (BAPPEDA), to help establish project guidelines. The PWG decided to use geographic distribution as the first criteria in site selection, suggesting that one be a northern island, one be on the Sulawesi Sea coast and one on the coast of the Maluku Sea. Other criteria were the size of the population dependent on coastal resources; the potential of coastal and marine resources; awareness of the community and commitments for development from it and its officers; the development status and progress of the village; village harmony; coastal management issues; that it be representative of a small island; accessibility; and finally, location in an area with potential influence on neighboring villages (Crawford et al. 1997).

As a first step in the selection process, the summary and data on the 20 sites in the preliminary assessment were reviewed and sites were ranked according to the criteria above. Each village was given a score of 1–3 (1 = low, 2 = medium, 3 = high) for each. The scores were totaled and the top two villages from each of the three geographic regions were evaluated further for final selection. This evaluation was based on information collected in the field by project staff and PWG members. The stated objectives of the field trip were to obtain more information about the candidate villages (especially concerning criteria not covered in the preliminary assessment), to introduce the candidate village to members of the PWG and extension officers, and finally, on the basis of the preliminary appraisal and results of the field trip, to select three project locations from the six candidate villages.

Methods used during the field trip included collection of additional secondary data, semi-structured interviews with the kepala desa, kepala dusun, informal leaders,

social groups (fishermen, women, etc.), members of the community and other stakeholders, and direct observation. One day was spent at each site. In the north, the villages of Talise and Gangga Satu were visited. After completion of the field visits, the team met to discuss findings and observations and to make a final determination of field sites. In this case, the group quickly came to a unanimous decision that Talise should be the field site. Specific considerations expressed by the group members in this decision were the conservation-mindedness of Talise, as demonstrated by almost 10 years of weekly beach clean-ups in Dusun Tambun, and a local ordinance protecting mangroves from being cut. In addition, the group felt that socio-political conflicts present in Gangga Satu would not make it a good site.

On the Sulawesi Sea coast, Blongko and Bajo were visited. In the case of these two villages, the field team was almost evenly split on which village should be selected. The merits and limitations of each site were discussed for several hours. Finally, a vote among the team members was taken and Blongko selected. Factors influencing the decision of Blongko included the cleanliness of the village, the support of the kepala desa and his apparent respect within the community, and again, the community's previous efforts to protect its mangroves from being sold and cut by outsiders. In addition, several members of the team felt that although Blongko had fewer coastal management issues than Bajo, this simplicity would help in seeing quicker results on the ground, a key strategy of the project in North Sulawesi. In the case of Bentenan and Tumbak, which are adjacent villages, the overlap in community use of the sea space offshore led to a decision that, rather than selecting one over the other, the site should include both.

In Example 5, the additional criteria for site selection used by project personnel and members of the PWG necessitated further fieldwork, but the preliminary assessment was used to select the six candidate sites. Use of criteria such as commitments from the community and its officers, and village harmony, while facilitating pilot project development, may also lead to a false impression of the ease with which such projects can be established. In essence, though the project and PWG stacked the cards in their favor, it yielded both positive and negative consequences. In addition, criteria such as village harmony and community commitment are difficult factors to determine in a brief, one-day visit to a community. PWG members made decisions concerning these factors relative to the other candidate sites during follow-up visits. Nevertheless, in several of the selected villages, intra-community social dynamics, which have made project work more difficult, only came to light after extension workers had been assigned full-time in the villages for several months. In the final analysis, however, based on their best assessment of the project's needs, the project personnel must weigh the consequences and make a choice.

3

BASELINE ASSESSMENT AND PROBLEM IDENTIFICATION

3.1 INTRODUCTION

Once CB-CRM sites have been selected on the basis of the rather sketchy data provided by the preliminary appraisal, it is necessary to obtain more detailed baseline information from communities selected for pilot projects. This section describes techniques for establishing a techno-socioeconomic baseline[2] for both later evaluations and development of CB-CRM activities. The techno-socioeconomic information is only part of an adequate baseline. The baseline must also include environmental information that should be collected at the same time as the socioeconomic information. Methods for establishing environmental baselines are beyond the scope of this guide and are covered in other publications (English et al. 1994, Fox 1986, McManus et al. 1997).

Concurrent with the collection of environmental and techno-socioeconomic baseline information at the pilot project sites, it is necessary to collect information from nearby control site communities. Control sites are important for several reasons. A significant question associated with any coastal resources management project concerns its relative impact on the coastal ecosystem, including its human and non-human components. Ideally, both of these components will benefit from a coastal resources management project. The only way we can determine these impacts, however, is by establishing a baseline of both techno-socioeconomic and environmental information that can be compared with similar data collected during and after establishment of the management strategy. It is obvious, however, that factors other than those generated by a management strategy impact the socioeconomic and environmental status of an area. Changes in weather patterns, in infrastructure, in the social, political and economic context of the communities involved can all have an impact on the socioeconomic and natural environment. In other words, outside forces, both natural and unnatural, can impact an ecosystem. Therefore, in addition to baseline information, it is necessary to collect information from similar communities that can be used as controls to determine whether the new coastal resources management strategy or some other factors have influenced the ecosystem.

---

[2] Although not strictly necessary, "techno" has been appended to socioeconomic to emphasize the fact that a certain level of detail concerning the technologies associated with productive activities needs to be described as part of the baseline, because aspects of these technologies frequently impact aspects of the natural environment.

Given the complexity of a coastal ecosystem, it is not possible to select controls that are perfectly matched with the pilot project communities. This, however, is not a problem. The goal of the controls is not to determine the exact degree of project impact, but to determine if trends in the project communities differ from those in the controls and to try to separate out the effects of the project from the non-project variables. For example, if the quality of life has improved in a similar way or amount in both project and control communities, can the change be attributed to an overall improvement of the regional or national economy? Or has resource management in the project village improved harvesting and incomes, while the increase in the control community can be attributed to improved markets as a result of a new road? Likewise, where trends are different, both project and non-project variables must be examined in terms of their impact on the trends. Use of controls is not simple, but without them, it is impossible to discern the relative impact of project and non-project variables.

While controls are useful for determining project outcomes in terms of environmental quality and quality of life, they are rarely, if ever, used for CB-CRM project assessments. This concept therefore, may be difficult for project managers or funders to accept, as it requires added costs that do not directly produce on the ground results at project field sites. However, if time spans are long enough, and if decisionmakers are truly interested in determining project outcomes, particularly if the initial set of project sites are viewed as pilots for subsequent replication in a larger number of communities, then the use of controls must be given serious consideration. Individuals involved in project design, and project implementers responsible for monitoring and assessment, must be able to persuasively articulate the value of control sites to those who determine the budget.

The techno-socioeconomic baseline includes many of the same types of information that are included in the preliminary assessment, as well as additional information. The main difference is the level of detail, accuracy, and reliability. These differences result from the use of different methods, including the expenditure of a greater amount of time in data collection. The first part of this section describes general characteristics of the methods used in establishing the baseline. Following sections describe specific information requirements, along with methods used in data collection, and methods for converting the data into information for the baseline. Where appropriate, examples from actual baselines are used to illustrate the methods.

3.2 GENERAL METHODOLOGY

General methods used overlap somewhat with those used in the preliminary assessment, but as will become obvious, the application of more time results in more reliable and detailed information. The methods include:

- Review of existing information
- Mapping

- Observation
- Participant observation
- Key informant interviews
- Survey

Review of Existing Information

Review of existing information includes compiling all available secondary information on pilot project and control communities, and surrounding areas. This should include reports and statistics from regional and national statistics offices; fishery, agriculture and forestry offices; development agencies and local development offices; as well as the most recent detailed topographic, bathymetric, and aerial charts, if available. Legislation applicable to the area should also be collected, since it may indicate sanctuaries or closed areas, etc. Sometimes local people prepare histories of the community, or religious organizations keep detailed records on members. An attempt should be made to locate all this material for potential use.

Mapping

Mapping for the techno-economic baseline[3] involves making a chart, to scale, illustrating distribution of major natural features (for example, coral reefs, mangrove areas, lagoons, rivers) and major man-made features (houses and other buildings, agricultural areas, fish ponds, piers, etc.). Ideally, the Global Positioning System (GPS) and a rangefinder are used to increase accuracy.

Observation

Observation should be continuous while in the community. It is done while constructing the map, while conducting walks (the beach walk and the community walk-through, described for the preliminary appraisal), while conducting the survey, and while conducting almost any activity including eating and resting. Observation differs from participant observation in that the latter refers specifically to observations made while participating in a specific activity to collect information (fishing, seaweed processing, etc.).

Key Informant Interviews

Key informant interviews are those conducted with individuals who have knowledge of the subject matter being questioned. This method may involve interviewing key informants individually or in groups.[4] With the greater amount of in-community time involved in the

[3] These maps differ from those constructed by local people, which are used mainly to discover what is important to them and to discover features that may be missed by outsiders (Townsley 1993). Locally drawn maps, however, can provide information of use to the mapmaker.

[4] The term *"focus group"* is not used for these groups of key informants to distinguish them from the current use of the concept. The groups of key informants referred to here are more informal and spontaneous or

baseline, it is possible to evaluate the knowledge of the key informants and do more cross-validation than is possible during a preliminary evaluation. Key informants should be representative of different social groups in the community (by age, sex, status, ethnicity) to ensure representative information is obtained. Comments in the preliminary assessment section concerning the cross-validation of key informants' information apply to the collection of baseline data as well (see Section 2.3, page 11).

Sample Survey

The use of formal survey methodology clearly distinguishes the baseline from the preliminary assessment. Only a survey, conducted using proper methods (random sample of sufficient size), can be used to determine the distribution of specific variables across households and individuals in the community. Sample size can be determined using power analysis (Cohen 1988) and randomization can be achieved using commonly accepted procedures (Henry 1990). All efforts should be made to insure that the sample is representative of different social groups in the community, by age, sex, status and ethnicity.

For all types of data acquisition it is important to obtain data from and about all social groups, such as those distinguished by age, sex, ethnicity, and status or relative wealth. This is important for CB-CRM planning. For instance, if there are destructive activities occurring, we need to know if a specific, identifiable group is responsible and make sure that they are consulted and involved in the planning and management process. Similarly, if proposed regulations or policies affect one social group more negatively or positively than another, particularly with respect to prohibitions and restrictions on use, it is important to account for these differences in the planning process. For example, issues such as a lack of easily available drinking water supply may affect one gender and/or age group more than another. Women or young children may be the primary water gatherers, in terms of their daily activities and chores, so the effect of a project intervention (new drinking water supply system) will be positive with respect to these social groups. Additionally, we know in certain participatory planning and assessment activities, social categories such as gender, age, social status and ethnicity affect how and whether people participate in CB-CRM activities. For example, daily schedules may determine when they have free time to participate, or cultural expectations may influence the manner in which they participate. Therefore, participation techniques may have to vary depending on the age, social status, ethnicity and gender of groups involved in various activities.

---

are involved in an activity that brings them together in the normal course of daily activities (fishing boat crews). The focus group is usually formally constituted (members are suggested by a community leader or key informant) and the meeting for the data acquisition session is usually scheduled at a specific time and place. Use of focus groups places unusual demands on community members' time (they might prefer to be involved in some other activity) and has a greater probability of producing unrepresentative information (members may be selected on the basis of their agreement with the selector's agenda, or the group may contain strongly opinionated members who can influence other group members). Focus groups tend to provide more information on the group dynamics of interaction than reliable data on a specific topic.

Personnel Requirements

The personnel required for conducting the techno-economic baseline should manifest some of the same characteristics listed for the preliminary assessment team. For example, team leaders should have broad experience in coastal communities, with extensive knowledge of traditional and modern coastal resource productive activities, and they should be able to recognize most fishing gear and to identify organisms with the aid of a guidebook. Ideally, if environmental baselines are conducted simultaneously with techno-economic baselines, team leaders should be senior social and biological scientists; other team members should be junior or higher level scientists. All team members should be in good physical condition, able to walk tens of kilometers a day, day after day, in the prevailing local weather conditions. They should be sufficiently adaptable to go to sea with local fishers to observe fishing techniques, if necessary. In addition to personnel with these characteristics, there should be at least one senior individual who has data analysis skills, including knowledge of data reduction techniques, such as factor analysis, scale construction, and non-parametric and parametric multivariate analysis.

Time Requirements

The time involved in conducting the baseline will depend on team size and equipment, geographical extent of the community and coastal resources, distribution and size of population, and the number and complexity of activities and occupations. A typical coastal village (population of several hundred to several thousand), composed mostly of small-scale fishers would take less time than a coastal city of several hundred thousand, with the many complex activities and occupations that characterize large urban areas. A large team could complete the job more rapidly than a small team. A team with several inexperienced members will take longer than an experienced team, as additional time will need to be devoted to careful quality control and training. Finally, a team with adequate transportation facilities (boats, cars or motorcycles) could cover a large geographical area more rapidly than one without. Despite these caveats, an estimate, based on extensive experience conducting this type of data collection in coastal communities, is presented below. Sufficient information is provided to allow the reader to generalize to many of the conditions encountered in coastal communities.

Locating, compiling and assessing secondary information on the target community should take anywhere between 16 and 32 human hours (HH), depending on amount, location and accessibility of information. Travel to and from site cannot be estimated due to the wide range of variability, and will have to be estimated case-by-case.

Once at the site, preliminary preparation (meeting local officials; the preliminary assessment, if incomplete; adapting a survey form to local activities and conditions) will take between 16 and 24 HH. General mapping of the community (see Table 3) takes between 24 and 32 HH depending on the complexity and size of the site. Pre-testing the

Table 3: Estimated time requirements for baseline assessment

Activity	Human Hours
Secondary data acquisition and assessment	16–32
Preliminary on-site assessment	16–24
Mapping	24–32
Pre-testing survey	16
Administering survey (1.5 hr per household x 50)	75
In depth description of complex activities[a]	47–87
In depth description of simple activities[b]	46–54
General discovery activities	30
Survey data coding	30–40
Data analysis and write-up	120

[a] The minimum assumes 3 complex activities with one on-board participant observation. The maximum assumes the need for participant observation of all three activities.

[b] The minimum assumes 10 simple activities with participant observation necessary for two. The maximum assumes participant observation of three activities.

survey questionnaire will take about 16 hours, and the survey itself will take around 75 HH (50 households, interviewing one adult male and female per household, with a total of 1.5 HH per household, travel between households and introductions included).

Interviewing and participant observation to obtain in-depth information on coastal activities will vary according to the complexity of the activity and whether or not on-board observation is necessary (with respect to fishing). With respect to an important complex activity such as *giop* fishing, expect to spend a maximum of about 29 hours obtaining the required information. This will include at least nine hours of interviewing (three hours each, including travel, with three separate key informants) and an estimated 20 hours on-board for participant observation, if deemed necessary (preparation for the trip, sailing time, fishing time, unloading and distribution of catch). Experience suggests that one can expect to find about three such activities in a coastal village, with at least one requiring on-board participant observation to obtain and confirm necessary information, resulting in a total of 47 HH. If participant observation is required for all three activities, the total HH increases to 87. Simpler activities, such as seaweed culture, require a maximum of about 11 hours per activity. This includes three hours interviewing (three separate key informants, about one hour each) and eight hours participant observation (participating in short fishing trips, visiting seaweed culture areas with farmers and observing activities). There are usually about 10 of these simpler activities with two or three requiring participant observation, resulting in about 46 to 54 HH of data acquisition time. Finally, at least another 30 HH should be allocated to general discovery activities. This involves walking around, observing and talking to residents, with the goal of

discovering significant behaviors not yet uncovered by the other activities. On site data collection, then, will require between 254 and 318 HH. For instance, a team of approximately five persons can complete data collection in a period of approximately one or two weeks per village.

Once the survey data has been collected, it must be coded, either at the site or back in the main office. One advantage of coding on-site is immediate data quality control. Problems in the data (missing data, inadequate responses, etc.) can be identified and immediately corrected. Experience indicates that coding data from 50 households takes approximately 30 to 40 HH. If done on-site, total effort there would increase to between 284 and 358 HH. Analysis and write-up of the data will take about 120 HH (approximately one to two weeks for a team of two), resulting in a total of between 420 and 510 HH**.** This is a small and reasonable amount of time given the importance of the information obtained. While field data gathering can be conducted with a larger team, particularly for administration of a survey instrument, coding, data analysis and report writing can be done easily and efficiently by one or two. Table 3 summarizes these time requirements.

3.3 BASELINE COMPONENTS: METHODS, ANALYSIS, AND PRESENTATION

The baseline has a number of specific components, ranging from a general description of the community and its setting to details concerning productive activities. These general components will be described along with methods of data collection, analysis and presentation. Examples from actual baselines will be provided to illustrate both the process and the final product.

Environment

A brief description of the environment should be included in the techno-socioeconomic baseline. Some information can then be abstracted from it, if the environmental baseline is conducted at the same time. The mapping exercise, if properly equipped with a range finder and GPS, will also provide input to the environmental description. Finally, available topographic, bathymetric and aerial charts can be used for preparing some of the environmental description, which should also include evidence of the impact of human activities, wherever possible.

The sample description of the environment in Example 6 is a slightly modified section drawn from the baseline conducted in Bentenan and Tumbak, North Sulawesi, Indonesia (Pollnac et al. 1997b). The environmental baseline was conducted simultaneously with the techno-economic baseline, so it was possible to provide more detailed environmental information. The map included in Example 7: Population and Settlement Patterns, also provides some environmental information.

Example 6: Environment

Bentenan is located on a serpentine, light-colored sand beach one degree north of the equator on the Maluku Sea coast of Minahasa. A river runs through the village, exiting to the sea at the southern edge of the population concentration. Wetlands, with mangrove swamp and pools of standing water, back the residences built along the beachfront. Small hills separate the slightly concave beaches that characterize the coastline. South of the residential area, a long stretch of curved beach, backed by brush, small trees, coconut palms and pasture, sweeps some 2.5 km south-southeast to Cape Popaya, a finger-shaped point of land scarcely one-half kilometer from the western tip of Bentenan Island, a teardrop-shaped island about .75 km by 1.5 km, with its narrow end pointed toward the cape. At this point, the coral reefs fringing both the mainland and the island almost meet. Off the north shore of Bentenan Island the reef extends .75 to 1 km to the north. The village also has land on Bentenan Island, though most of the island remains as untouched forest. The sea floor drops to 100 m some 3.5 to 4 km offshore of the populated area. Village statistics (Profil 1997a) indicate that the village has a total land area of 800 ha, with 500 ha classified as farmland.

Just to the south of Bentenan lies the village of Tumbak. Tumbak is located on a narrow strip of land on the tip of Cape Sompini slightly over 58 minutes north of the equator. Bounded on the northeast by Sompini Bay, on the east through the south by the Maluku Sea, and backed by a large mangrove swamp, Tumbak is effectively surrounded by water. Paddy rice fields, belonging to another village, extend the wetlands back even farther northwest into the mainland of Minahasa. Tumbak's relatively steep, gritty, black gravel beach contrasts markedly with the light-colored sands found just across Sompini Bay. To the east, slightly more than a kilometer away, lies Bentenan Island, slightly less than a kilometer northeast of Tumbak across Sompini Bay. Tumbak claims part of Bentenan Island, a small portion of which is used for agricultural purposes. Coral reefs fringe the coastline of Tumbak, Sompini Bay and Bentenan Island. The sea is relatively shallow in the bay and the strait between the village and the island, but to the south, it drops to more than 100 m in a little less than 2 km. According to *Kabupaten* statistics (Profil 1997b) village lands total 85 ha,[1] none of which is categorized as suitable for agriculture.

There are approximately 213 ha of mangroves, with the majority located in a large forest stand behind the village of Tumbak. Additional mangroves are found in narrow strips around almost the entire perimeter of Sompini Bay and along the northwest and southwest perimeters of Bentenan Island. These communities are dominated by *Rizophora* (red mangrove). While some cutting of mangroves occurs,

[1] Statistics published at an earlier period indicate an area of 135 ha. We cannot verify which is correct.

in general the area is considered quite healthy, and tree trunks more than a meter in diameter can easily be found. Attempts are being made by Tumbak residents to reforest a small mangrove patch just behind the village for a windbreak. A small mangrove and nipa swamp area in front of the Bentenan Beach Resort has been converted to milkfish ponds and an artificial lagoon. Due to the high-energy waves and open sandy beach environment, there are no mangroves along the Bentenan shoreline.

Seagrass patches totaling 51 ha are found along the fringes of Sompini Bay just beyond the mangrove edge, as well as on the inside of the reef flats from Popaya Point to Bentenan and encircling Bentenan Island. Fringing coral reefs stretch almost the entire distance from the Bentenan Beach Resort to Popaya Point, and along the stretch in front of Tumbak village referred to as Sompini Point. Two small patch reefs occur at the entrance to Sompini Bay. The small islands of Punten and Balingbaling off Tumbak also have narrow reefs encircling them. Bentenan Island is almost entirely encircled by coral reef, with a particularly extensive reef flat to the north of the island, which faces Bentenan village. The entire reef area in Bentenan and Tumbak is approximately 198 ha.

The reef around the small islands of Punten and Balingbaling, on the south side of Bentenan Island, and in front of Tumbak village, tends to be in the best condition, averaging from 50 to more than 75 percent live coral cover. The reef areas in the mouth of Sompini Bay and along the fringing reefs from Sompini Point to Bentenan Beach Resort are considered to be in poor condition, averaging less than 50 percent live coral cover. The area in front of Bentenan village with the poorest coral condition is also the area reported by long-term residents to have historic erosion problems.

Significant bomb-fishing damage was observed on the north reef flat of Bentenan Island, in front of Bentenan Beach Resort and Popaya Point, and around the small islands of Balingbaling and Punten. Large numbers of destructive Crown-of-Thorns starfish were observed on the reefs in the mouth of Sompini Bay, on the western end of Bentenan Island and around Punten Island. In one location on Punten Island, 45 Crown-of-Thorns were spotted in one small cluster.

Perhaps not coincidentally, the areas with poor coral cover tend to be the areas with observed bomb damage and Crown-of-Thorns infestations. However, in spite of the damaged reef conditions in some locations, there are still many areas with spectacular coral cover and high percentages of branching Acropora corals. In fact, the reef just in front of Tumbak village has the second highest percentage of overall coral cover and the highest percentage of Acropora coral among the 12 transect sites surveyed. After describing the surprise of finding unexpectedly good coral condition in front of the village, one elderly woman remarked that bomb-fishing and coral mining are not conducted in front of the village, for fear that they will lead to erosion of the narrow strip of land where most of the settlement resides.

Fish census surveys tend to mirror the condition of the coral reefs. Large fish and commercially sought reef fish were rarely observed, but a few small napoleon wrasses, a highly sought-after species for the live fish trade, were observed on the south side of Bentenan Island and on Sapamabagak reef in the entrance to Sompini Bay.

In general, the marine and coastal environments of Bentenan and Tumbak tend to be in good condition. Certain stretches of reef and some of the mangrove forest areas are in excellent condition and exceptionally beautiful. They offer valuable assets for biodiversity conservation and potential ecotourism development. Unfortunately, bomb-fishing and other destructive forms of fishing, coral mining, mangrove harvesting and Crown-of-Thorns infestations suggest that environmental degradation is occurring.

Population and Settlement Patterns

The information here should include the number of households, total population, recent population trends and age distribution of the population. All this can usually be derived from community records. Settlement pattern is determined by the mapping exercise. Example 7 from Tumbak, North Sulawesi (Pollnac et al. 1997b) provides an illustration of this type of information and the results of a mapping exercise. Mapping was conducted by one of the field team members.

Infrastructure

Infrastructure information collected for the baseline is the same as for the preliminary assessment. It includes enumeration or extent of hospitals, medical clinics, resident doctors, resident dentists, secondary schools, primary schools, water piped to homes, sewer pipes or canals, sewage treatment facilities, septic/settling tanks, electric service hook-ups, telephones, food markets, hotels or inns, restaurants, gas stations, banks, public transportation, and paved road. One main difference is that information derived from key informant interviews and secondary information can be verified during the longer stay in the community and through the survey. For instance, in the example derived from the baseline for Tumbak, North Sulawesi (Pollnac et al. 1997b), the *Kepala Desa* reported that approximately 26 percent of residents are connected to the national electric service, whereas the survey indicated that 85 percent of the households in the sample have electricity, a difference too large to be attributed to sampling error. Revisiting the village, it was found that the figure provided by the head of the village referred to official hook-ups. Many people simply plug into their neighbor's supply, accounting for the discrepancy.

Example 7: Population and settlement patterns

Total population of Tumbak is 1,130, distributed among 257 families living in 189 households (Profil 1997b). The population has increased 15 percent since 1985. Over one third (34 percent) of the population is 15 years or less in age, about one-fifth (21 percent) between 16 and 25, approximately another third (31 percent) is 26 to 45, and the remaining14 percent are 46 or older. The population is settled on a thin finger of land between the mangrove swamp and the sea (Figure 2). In general, the settlement pattern of the village can be classified as nucleated coastal.

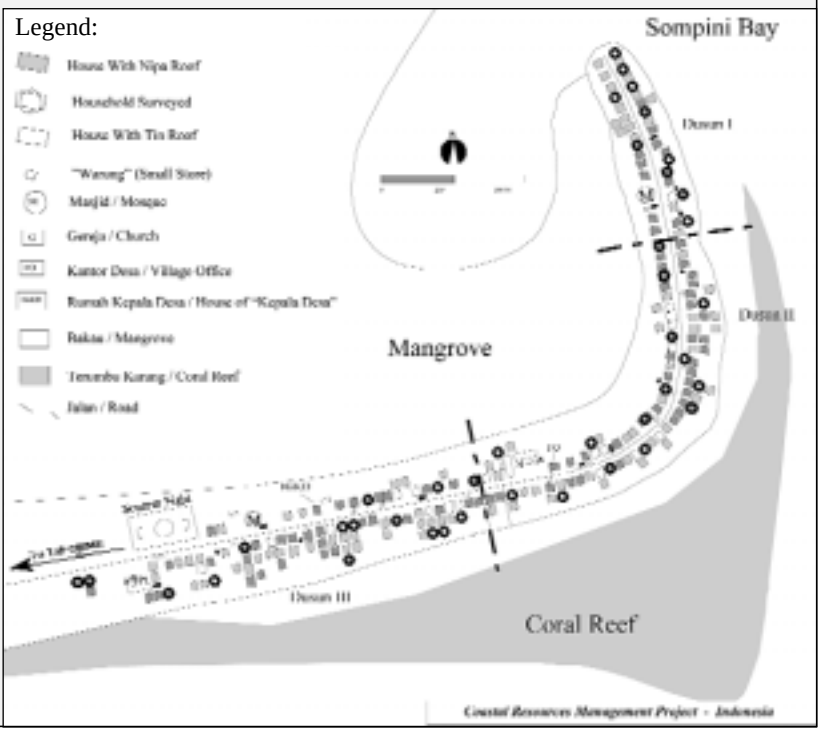


Figure 2: Map of Tumbak village

Example 8: Infrastructure

Tumbak has 1 km of asphalt road (3 km stone, and 0.5 km dirt), as well as one bridge, which reportedly needs maintenance. *Microlets* and boats link the community to nearby towns. The town nearest to Tumbak with full services (bank, gas stations, markets, government offices) is Belang, the seat of the *kecamatan* (district government) which is about two hours and 28 km to the south (Profil 1997b). People and products can also be transported by the three automobiles, one motorcycle, 20 bicycles, and numerous boats recorded in the village statistics (Profil 1997b). The pipe meant to deliver fresh water to the community is out of service, so residents must travel by boat to the river for fresh water, which is transported back to the village in plastic jerry cans. Approximately 8 percent of the households have septic or settling

tanks and 26 percent are officially connected to the national electric company lines (Pollnac et al. 1997a). The survey indicates that 85 percent of the households have electricity, many of them unofficially connected to a neighbor's supply. There are no telephones, gas stations, markets, restaurants, or accommodations (hotels, guest houses) for visitors. There is one elementary school (Profil 1997b).

Social Structure

Occupations

Occupations are a very important aspect of social structure as well as an indicator of the relative importance of different components of the coastal resource. Secondary data is an inadequate source of information concerning occupations, since most published statistics only include the full-time or primary occupation. Most coastal communities, especially in rural areas, are characterized by occupational multiplicity—a given individual or household may practice two, three, four or more income or subsistence-producing activities. The only way we can determine the distribution and relative importance of these activities is with the use of a sample survey.

Ideally, one should obtain the value of all coastal activities that contribute to the householdæfor example, the income earned from fishing, the value of fish brought home for food. The problem is that most primary producers in developing economies do not keep records of income, and income from fishing, for example, varies so much from day to day that it is difficult to provide an accurate figure for weekly or monthly income. It not only varies from day to day, but also from season to season. The difficulty with estimating income is further compounded by the occupational multiplicity mentioned above.

If it is possible to obtain income values for these productive activities, do it. Experience, however, has indicated that an excessive amount of time is required to obtain this information, and it is relatively unreliable. Since it is the relative importance of the activities that is significant to coastal planning, the relative importance of the activity to the individual household is the minimally acceptable level of measurement. This means that it is sufficient to obtain a ranking of the activities for each household.[5]

Education

Years of formal education are often related to social status, as well as receptivity to new information; hence, it is an important indicator that should be included in the baseline. Community records frequently include information concerning the distribution of

[5] Household economic well-being is estimated based on an analysis of material possessions, which is described below. Ranges of income from specific activities are estimated from key informant interviews, which are also described below.

Example 9: Occupations

A survey interview form was administered to a random sample of 40 households in Tumbak. Respondents were requested to report all activities that contribute to household income and food. After the list was constructed, respondents were requested to rank each activity in terms of relative importance for household income and food. Percent distribution of rankings for each activity was calculated resulting in Table 4.

Table 4: Percent distribution of ranking of productive activities in coastal dusuns of Tumbak

Activity	1st	2nd	3rd	4th	5th	6th	Total
Farming	—	10.0	12.5	10.0	02.5	02.5	37.5
Fishing	70.0	07.5	05.0	02.5	—	—	85.0
Gleaning	02.5	02.5	05.0	07.5	10.0	—	27.5
Fry collection	02.5	—	—	—	—	—	02.5
Ornamental fish	02.5	10.0	02.5	—	—	—	15.0
Processing	—	25.0	05.0	—	—-	—	30.0
Seaweed farming	—	17.5	05.0	—	—	—	22.5
Fish trading	15.0	07.5	10.0	—	02.5	—	35.0
Seaweed trading	—	—	02.5	—	—	—	02.5
Other trading	—	02.5	—	—	—	—	02.5
Boat builder	—	—	02.5	—	—	—	02.5
Carpenter	02.5	05.0	—	02.5	—	—	10.0
Teacher	02.5	—	—	—	—	—	02.5
City salesman	02.5	—	—	—	—	—	02.5
Coral mining	—	—	—	02.5	—	—	02.5
Selling ice	—	02.5	—	—	—	—	02.5
Remittance	—	—	—	02.5	—	00.0	02.5
Total	**100**	**90**	**50**	**27.5**	**15.0**	**02.5**	

educational attainment. Years of formal education should also be collected as part of the baseline social survey to explore possible relationships between education and other variables included in the survey. The example from Tumbak (Pollnac et al. 1997b) illustrates several points concerning the presentation of this data. First, data should be disaggregated by sex where possible. Second, data from the survey should be collected in terms of number of years (a real number), but the table should be presented using the same categories as used in the community records to facilitate comparison. If some important categories are left out of the community statistics, such as *elementary* or *six years*, as in the example from Tumbak, the category can be added to the table derived from the sample survey. Third, data from the survey will differ from community records due to the fact that the survey contains only information referring to the respondent, who is an adult.

Example 10: Education

Years of formal education are often used as an indicator of social status; hence, distribution of education can provide some insight into the social structure of Tumbak. Village statistics for Tumbak did not include elementary education levels, but they suggest that females are receiving less education than males (Profil 1997b; Table 5). The sample survey of household heads (and their spouses, when available for interview) presents a different picture of educational attainment (Table 6). This is to be expected since the household head does not necessarily represent the educational level of all household members, whereas the village statistics include the entire population. Analysis of the sample survey data indicates no statistically significant difference between male and female education levels among survey respondents (male = 6.4, female = 5.4, $t = 1.256$, $df = 55$, $p > 0.05$).

Table 5: Distribution of years of formal education in Tumbak

Years	Males	Females	% of Population
9	36	20	4.9
12	28	6	3.0
>12	2	1	0.3

Source: Profil 1997b

Table 6: Education levels of survey respondents in Tumbak

Education	Females	Males	Total %
Some	08	11	34
6	16	14	54
9	01	04	09
12	—	02	04

N=56

Land Ownership

Land ownership is another good indicator related to the social structure of a community. Land ownership is almost always recorded in community records, but if not, a question can be added to the sample survey. In the example from Tumbak provided below, distribution of land ownership was extracted from village statistics (Pollnac et al. 1997b).

Example 11: Land ownership

Another indicator of social structure is the distribution of land ownership. Village statistics (Profil 1997b) indicate that among land owners in Tumbak, 71 percent own less than one-half hectare. The distribution of land ownership among all villagers is found in Table 7.

Table 7: Distribution of land among land owners in Tumbak

Amount of Hectares	Percent
<0.1	23.8
.1–.5	47.6
.6–1.0	03.2
1.1–1.5	10.7
1.6–2.0	09.9
3–5	04.0
6–8	00.4
9–10	00.4

Source: Profil 1997b

Material Style of Life

Material style of life is a good indicator of relative social status in a community and can also be used as an indicator of wealth. Hence, it is a good indicator to be compared across time to determine changes in wealth where it is difficult or impossible to obtain accurate income data. Material style of life can be measured using a list of items concerning house structure and furnishings. The lists should be appropriate to conditions within the target areas, to facilitate comparisons and measure change.

Scales for this indicator are not simple to construct. For example, house structure indicators might include four roof types: thatch, wood, tin and tile. One could select only the most expensive type and use it in the list, but that would leave out all the gradation available in the different types. If the different types are used, how does one assign a value to each type? The addition of different wall, floor, and window types, as well as appliances and other furnishings, greatly complicates the problem. The measure cannot be a simple addition of items. Items must be evaluated, accepted or rejected, and given weights based on their actual distribution. There is a long history of scale construction which deals with these problems, and techniques such as Guttmann scale analysis and factor analysis have been developed. Accurate scale construction is needed to make meaningful comparisons between individuals and groups of individuals (occupational subgroups, communities), as well as to make comparisons between different time periods, such as pre- and post-project.

The example provided below analyzes material style of life data from four villages in North Sulawesi (Pollnac et al. 1998), two pilot project sites (Tumbak and Bentenan), and two control sites (Rumbia and Minanga). An example with several sites is used to illustrate methods for comparing results. In this example, it is a comparison of pilot project and control sites, but the same methods would be used to conduct a post-evaluation, comparing the same sites at time-one (pre-project) and time-two (post-project).

Collection of the material style of life data during the survey is not as difficult and time consuming as it may appear, when faced with a long list of items, such as those in the example. An examination of the list clearly indicates that many of the items are visible to the interviewer, who can simply check them without asking the respondent whether they are present or absent.

Example 12: Material style of life

Material style of life, as indicated by house structure and furnishings, provides an indicator of relative wealth or social status in a community. As part of the baseline survey conducted in Bentenan and Tumbak and the control sites (Rumbia and Minanga), the presence or absence of 28 aspects of house construction and furnishings, considered by the research team to be indicative of differential social status, were recorded for each household included in the survey. The items and their percent distribution in the control and pilot project sites can be found in Table 8.

While the raw distributions of these material items are somewhat useful for detailed comparative purposes, it is perhaps more expedient to determine any patterned interrelationships within the data that can be used to construct multi-item scales, providing a clearer picture of the distribution of material wealth within and between the two villages. To accomplish this goal, the 28 material style of life variables listed in Table 8 were factor analyzed using the principal component analysis technique and varimax rotation. The scree test was used to determine the optimum number of factors to be rotated (Cattell 1966). An examination of the first principal component analysis of this data indicated that seven items (tile floor, wooden wall, wooden windows, tile roof, wooden roof, bench and water piped into the house) manifested rotated loadings less than 0.40 (all except wooden wall had loadings less than 0.20). These items also have very low percent occurrence in the sample households; therefore, they were eliminated from the analysis, and a subsequent analysis was conducted on the remaining 21 variables. The result of this analysis can be found in Table 9.

Table 8: Percent distribution of material items

Item	BT	RM
Bamboo wall	30	31
Cement wall	57	49
Wooden wall	15	24
Water pipe	1	0
Glass window	42	39
Open window	26	37
Wooden window	33	39
Fan	0	5
Cement floor	73	73
Dirt floor	7	31
Tile floor	1	0
Wooden floor	22	4
Radio cassette	16	35
Refrigerator	2	6
Nipa roof	59	61
Tile roof	1	0
Tin roof	40	45
Wooden roof	5	0
Satellite dish	6	12
Indoor toilet	16	12
Television	10	22
Bench	69	98
Display cabinet	41	47
Chairs	80	71
Cupboard	25	55
Living room set	68	61
Modern stove	22	31
Electricity	80	80
N	**81**	**51**

Note: BT = Bentenan & Tumbak; RM = Rumbia & Minanga

The majority of the items loading highest on each of the two components in Table 8 provide some indication of patterns of interrelationships of the items in the sample households. In turn, these patterns can be interpreted as dimensions of material style of life. For example, the items loading most highly (either negative or positive) on component one (labeled "Basic" in Table 9) refer to structural features and basic furniture of the dwelling (windows, floors, walls, roof type, chairs, living room set, etc.). Items loading highest on component two (labeled "Advanced") are relatively expensive accessories or appliances, which elaborate the structure. Together, the two components account for 45 percent of the variance in the data set, a modest but respectable amount. We refer to the first component as basic and the second as advanced.

Table 9: Principal component analysis of material style of life items

Variable	Basic	Advanced
Bamboo wall	-0.806	-0.053
Cement floor	0.798	0.041
Cement wall	0.775	0.207
Tin roof	0.736	0.292
Nipa roof	-0.731	-0.292
Glass windows	0.682	0.294
Living room set	0.636	0.124
Chairs	0.611	-0.052
Wooden floor	-0.517	-0.071
Display cabinet	0.505	0.359
Satellite TV dish	0.034	0.859
Television	0.100	0.770
Refrigerator	0.048	0.634
Fan	-0.007	0.590
Radio cassette	0.381	0.514
Modern stove	0.331	0.501
Indoor toilet	0.272	0.494
Cupboard	0.443	0.407
Open windows	-0.470	-0.190
Electricity	0.403	0.172
Dirt floor	-0.469	-0.043
Percent of total variance explained	**27.948**	**16.813**

Component scores were created to represent the position of individual households on each of the two components. The component scores are the sum of the component coefficients times the sample standardized variables. These coefficients are proportional to the component loadings. Hence, items with high positive loadings contribute more strongly to a positive component score than low or negative loadings. Nevertheless, all items contribute (or subtract) from the score; hence, items with moderately high loadings on more than one component (cupboard, in the analysis presented here) will contribute at a moderate level, although differently, to the component scores associated with each of the components. This type of component score provides the best representation of the data. These scores are referred to here as material style of life component scores (MSL component scores). They are standardized scores with a mean of zero and a standard deviation of one.

A comparison of mean MSL component scores across the project and control sites indicates that the sites differ minimally on the basic component (means; standard deviations = 0.058; 0.972 and -0.092; 1.047 respectively; $T = 0.839$, $df = 130$, $p > 0.05$). The sites differ significantly with respect to the advanced

component scores, however. Mean score on the advanced component for the project sites is -0.175 (sd = 0.838) and for the control sites, 0.278 (sd = 1.170). This difference is statistically significant (T = 2.402, df = 130, p = 0.02).[1] Hence, the project sites tend to have a lower material style of life with respect to relatively expensive accessories and appliances, but not with respect to basic household structures and furnishings.

[1] Although the difference in scores seems small, the component scores are standardized, with a mean of 0.0 and a standard deviation (sd) of 1.0; hence, the difference between the two groups is almost one-half a standard deviation of the scores for the entire sample. Approximately 68 percent of scores lie within 1 sd of the mean, 95 percent within 2 sd, and 99.7 within 3 sd.

Ethnicity and Religion

Both ethnicity and religion are important aspects of social structure. They are frequently related to group membership, loyalties, and other aspects of social behavior. The distribution of both ethnicity and religion in a community can be determined using several methods. Key informants (community officials, leaders of religious organizations, etc.) can be interviewed, or direct questions concerning religion and ethnicity can be part of the sample survey. In the example presented here, respondents to the Bentenan baseline survey were asked their ethnicity and religion (derived from Pollnac et al. 1997b).

Example 13: Ethnicity and religion

It was clear in the survey that the coastal *dusuns* of Bentenan are ethnically distinct from the inland *dusuns*. While households sampled from the inland *dusuns* are all ethnically Minahasan, the coastal *dusun* households are only 10 percent Minahasan. The majority of the coastal households identify themselves as Bolaangmongondow (42 percent), with 13 percent Gorontalo, and the remaining 35 percent distributed among seven ethnic groups (Bugis, Buton, Sangir, Bajo, Javanese, Tidore and Ternate). The residents of the coastal *dusuns* of Bentenan are, for the most part, either descendants of or immigrants from other areas. Religion also varies according to area of current residence. While the majority of the households (more than 97 percent) in the coastal *dusuns* of Bentenan identify themselves as Islamic, fully 100 percent of the households in the inland *dusuns* of Bentenan regard themselves as Christian.

Formal and Informal Associations

Various associations are often involved in the organization of community activities. Some are also directly involved in coastal productive activities. As part of the baseline, the name, number of members and functions should be determined for each association from key informants. First, a list of associations and their respective leaders can be obtained from community officials. Association leaders can be interviewed to determine membership and group functions. The example from the Bentenan and Tumbak baseline (Pollnac et al. 1997b) illustrates the kind of detail needed.

Example 14: Formal and informal associations

By law, both communities have a *Lembaga Ketahanan Masyarakat Desa* (LKMD) and *Lembaga Masyarakat Desa* (LMD) which are involved in community government. Both communities also have *Kelompok PKK* (household welfare groups). In Tumbak the main activity is the *Usaha Pendapatan Penghasilan Keluarga* (UP2K—Efforts of Household Income and Productivity) which helps finance fish trading, kiosks/small shops and home production of cakes. Capital is given to the *Kelompok PKK* which in turn loans it to capable members who desire financing for some activity. A portion of the loan is regularly returned to the *Kelompok PKK* by each borrower. In Bentenan there are three *Kelompok PKK*. First, is a UP2K which was initially financed by *Proyek Bantuan Desa* (Village Assistance Project); the assistance is Rp 500,000 per *desa* per year. The money is used to develop home businesses, such as fish trade (*tibo-tibo*), kiosks, and kiosks for food (small-scale, local restaurants). The money is allocated to several women who are considered capable of running such businesses. Second, is the *Usaha Perbaikan Gizi Keluarga* (UPGK—Efforts of Household Nutrition Improvement), which runs the POSYANDU (Integrated Service Unit) by developing and training new POSYANDU local volunteers, who provide assistance with household nutrition. Third, is *Bina Keluarga Balita* (BKB—care for children under five years), which is run and financed by the local community following suggestions made by the government. The members are mothers who have children under five years of age. This group provides food supplements, such as sweet mong bean soup (*bubur kacang hijau*), and carrot extract soup (*bubur sari wortel*), which are sold to the mothers. The revenue is used to continue the provision of these nutritious foods.

Both communities also have *Kelompok IDT* (*Inpres Desa Tertinggal*). In Tumbak there are three groups, each with 30 members, whose activities are fishing, seaweed farming, and fish trading. It was reported that each member received Rp 200,000 to run his/her business with the requirement that progress reports be submitted to group heads, the LKMD, and the kecamatan. In Bentenan there are three types of *Kelompok IDT*. First, three groups of farmers, each with 20–40 members,

whose main activities are reported to be *mapalus* (mutual assistance), *arisan* (a regular social gathering at which members contribute to and take turns at obtaining an aggregate sum of money) and savings union activity. Second, there are four groups of fishers, each with 20 to 40 members, and third, one group of small-scale businessmen, with 22 members.

Finally, among the formal groups, Tumbak has three *Kelompok Usaha Bersama* (KUB) facilitated by a government social department. Each group of 30 members focuses on different general types of fish (parrotfish, scad and fusilier). Each group was granted gear, a boat and motor. Ten percent of the revenue from fish captured is supposed to be banked, and the remaining 90 percent is shared among members. The boat belonging to one group was reportedly deemed unserviceable three years ago. The group now rents the motor for Rp 60,000 per month and shares proceeds according to the rule stated above.

Both villages also have informal groups (without a formal constitution). Tumbak has a Mosque Youth Association with 180 members and a *Majelis Taklim Untuk Ibu-Ibu* (Muslim study group for women). Tumbak also has several *arisan* groups. There are three types of *arisan* for weddings: youth groups which collect money (since 1962, now reportedly about 200 members), adult males who collect meat, and adult females who collect food and goods. It was reported that more than Rp 900,000 could be collected for one occasion. There is also an *arisan* for money composed of mature females in each *dusun* who meet every Friday night.

The informal organizations in Bentenan include groups of *mapalus* (mutual assistance). These groups are established for farming activities (*Dusun* 1, *Dusun* 2, and some people of *Dusun* 3). There are *mapalus* for women in each *dusun*; two *mapalus* for youngsters; six *mapalus* for men (5–20 members each); and *mapalus* for building materials (each member contributes 1–4 bags of cement). There are also seven clan groups (*Rukun Keluarga*) in Bentenan, each with about 30 members: *Rukun Lowongan, Rukun Rumbi, Rukun Tamandatu, Rukun Tulandi, Rukun Gioh, Rukun Ruata* and *Rukun Rumpun* (consists of three families). Some members of *Dusuns* 3 *and* 4 formed an *Organisasi Sosial Kerukunan Keluarga Nelayan* (OSKKN—Social Organization of Fisherman Family Groups) to support wedding ceremonies/parties, funerals, and health problems (sick residents). Bentenan also has two cultural groups: a group of *Tarian Maengket* (Maengket Dance) with 40 members and a group of *Musik Bambu* (bamboo instrument orchestra).

Both communities are part of a group of villages (reportedly including Wiau, Tatengesan, Minanga, and Rumbia) which are in the process of forming a *Koperasi Unit Desa* (KUD) with a marine focus. The group is still in the formative stages, and is being organized with the help of the owner of the Bentenan Beach Resort.

Governance of Coastal Activities

Introduction In general, for all coastal activities, information is needed concerning governance. Governance, as used here, refers to rules, either formal or informal, that govern the use of coastal resources. It also includes consideration of supportive government administrative structures. Aspects of governance have been related to the relative success of CB-CRM by many researchers.

Enabling Legislation One of the most important factors is perhaps enabling legislation, at the national and/or other supra-local level, which facilitates governance at the local level. For example, Felt (1990) suggests that the success of co-management is related to the level of decisionmaking authority granted to participants. Jentoft (1989) writes that legislation, delegating responsibility and authority to implement and enforce regulations, is an essential factor in enabling fishers' organizations to participate in co-management of the resource (also Kuperan Viswanathan and Abdullah 1994, Miller 1990). Most of Ostrom's (1994) design principles for sustainable community-governed commons depend on enabling legislation, embodying a minimal recognition of resource users' rights to organize and develop their own institutions without interference by external government authorities. It is also clear that enabling legislation is necessary for groups of users to be authorized to define boundaries and obtain security in tenure for resource use rights (Pomeroy 1994a, 1994b, Alcala and Vande Vusse 1994), as well as for users to participate in modifying use right rules, monitoring observance of rules, and devising and applying sanctions for infractions. (Ostrom's design principles of "clearly defined boundaries," "collective choice arrangements," "monitoring," and "graduated sanctions," respectively [1994:37–39].)

One of Ostrom's design principles, congruence between appropriation and provision rules and local conditions (1994:37) requires flexibility in enabling legislation. This is important in terms of the degree of freedom that participants have to fine tune the management options. In effect, where traditional or informal management systems exist, legislation should allow for its recognition and formalization (White et al. 1994a, 1994b). Feeney (1994) emphasizes the importance of the ability to adapt collectively agreed-upon resource use rules to changing situations. Jentoft and Kristoffersen (1989) note that one of the important features of the successful co-management system of the Lofoten fishery in Norway is that it can adapt to local variations and has flexibility in response to changing conditions. The degree of adaptability obviously depends on the specificity and flexibility of government guidelines and directives within which the local users must work. It is unrealistic to assume that the government would delegate all responsibility for management to the resource users, with no guidelines whatsoever.

The government may delegate authority for particular aspects of resource management to the local community, as in the Philippines, but without certain types of support and changes (for example, political will, funding for surveillance and enforcement

activities, restructuring of administrative and institutional arrangements), local measures may prove ineffective (Pollnac and Gorospe 1998, Pomeroy and Pido 1995, Pomeroy 1995). Pinkerton (1989) considers the existence of institutions providing a higher authority for appealing questions of local equity, or institutions providing external support and forums for discussion (for example, universities, NGOs) as being favorable preconditions for co-management.

Evaluation of Enabling Legislation Evaluation of enabling legislation must take into account all the important aspects of legislation discussed above. This involves analysis of published legislation. The most basic evaluation of this variable would consist of seven fundamental questions which can be answered either *yes* or *no*:

1. Does the legislation allow formation of user groups?
2. Does the legislation authorize user groups to define boundaries for their exclusive access?
3. Does the legislation provide or allow for the development of mechanisms guaranteeing security of tenure?
4. Does the legislation provide general guidelines within which user groups can devise and legally implement locally appropriate management rules?
5. Does the legislation provide for recognition and formalization of traditional or informal management systems, where they exist?
6. Does the legislation provide for supportive administrative structures for co-management functions such as:
   a. Resource monitoring?
   b. Surveillance?
   c. Enforcement?
   d. Conflict resolution?
   e. Information?
7. Does the legislation provide for participation of user groups in developing and implementing surveillance and enforcement methods?

Each of the above questions can be treated as an independent variable. They could also be summed, resulting in a composite measure of enabling legislation. If they are summed, a procedure would have to be developed to account for the five categories of supportive administrative structures, e.g., weight them 0.2 each. Alternately, each of the seven items could be analyzed at a more complex level, for example, analyzing exclusive access and boundary types (Pollnac 1984, 1998, Pido et al. 1996). An example of evaluation of enabling legislation is provided below.

Example 15: Enabling legislation

The following example of governance is derived from a post-evaluation of a CB-CRM carried out in Calagcalag, a coastal village (*barangay*) in the municipality of Ayungon, on the east coast of the island of Negros in the Philippines (Pollnac et al. 1996).

Foremost among the supra-community variables related to CB-CRM success is enabling legislation and supportive government administrative structures at the national and municipal levels. The Philippine Constitution of 1987 clearly implies that the ownership of natural resources (which includes living aquatic resources) is vested in the state (Section 2, Article 12), and Section 7, Article 13 states that local communities receive preference in exploitation of communal marine and fishing resources (PMO 1994). The Fisheries Act of 1975 (PD 704) and subsequent Presidential Decrees (PDs), Letters of Instructions (LOIs), and Fisheries Administrative Orders largely govern the management of fisheries, emphasizing both conservation and development. These measures were adequately summarized (PMO 1994:69) as follows:

> PD 704 considers the following activities illegal: (1) The use of nets with mesh sizes less than 3 cm when stretched, (2) fishing with explosives or poisons, and (3) possession of explosives or poisons by fishermen. It also prohibits commercial trawling (>3 GT) in waters of 7 fathoms deep or less. Later PDs and Letter of Instructions (LOI) banned commercial trawls and purse seines within 7 km of the coastline in specific areas or set the procedures for establishing such localized bans. LOI 1328 of 1983 extended the ban on commercial trawls and purse seines within 7 km of the coastline in all provinces. The restrictions on the area where trawlers may operate, as stated in PD 704 and LOI 1328, are often combined and referred to as the 7 km/7 fathom ban. LOI 1328 and Fisheries Administration Order (FAO) 164 set boundaries within which commercial trawls, purse seines, and buli buli should not operate.

Regarding coral reefs, the gathering of ordinary coral as well as the export of precious and semi-precious coral is prohibited by PD 1291 (Coral Resources Development and Conservation Decree) as amended by PD 1698. Certain coral reef resources, such as the mollusks *Charonia* and *Casis* are also protected (Fisheries Administrative Order 158, 1986 series). There are also laws that sanction the establishment of marine parks or reserves to protect coral reefs (PMO 1994). Significant with respect to the mangrove reforestation aspect of the Calagcalag CB-CRM, the government began to grant, through the Department of Environment and Natural Resources, 25-year renewable lease agreements for reforested areas. This provided mangrove dependent, small-scale producers in the coastal areas with security of tenure over areas they had replanted (cf. Alcala and Vande Vusse 1994, Vande Vusse 1991).

While these national laws still impact use of living aquatic resources, the Local Government Code (LGC) of 1991 (Republic Act 7160) places the management of municipal waters under the jurisdiction of municipal governments. This legislation facilitates CB-CRMs, especially as initiated by the Central Visayas Regional Project, by decentralizing decisionmaking concerning management of coastal resources and stimulating local participation in the process. Relevant sections from the LGC that apply to aspects of the Calagcalag CB-CRM are described below.

The definition of municipal waters (LGC, Section 131) is basic to understanding the geographic scope of local governance:

> Municipal waters includes not only streams, lakes, and tidal waters within the municipality, not being subject of private ownership and not comprised within the national parks, public forest, timber lands, forest reserves or fishery reserves, but also marine waters included between two lines drawn perpendicularly to the general coastline from points where the boundary lines of the municipality or city touch the sea at low tide and a third line parallel with the general coastline and 15 kilometers from it. Where two (2) municipalities are so situated on the opposite shores that there is less than 15 kilometers of marine waters between them, the third line shall be equally distant from opposite shores of the respective municipalities (as presented in Roldan and Sievert 1993:31–32).

Regarding this territory, the LGC states that "local government units shall share with the national government the responsibility in the management and maintenance of ecological balance within their territorial jurisdiction …" (Section 3, as presented in Roldan and Sievert 1993:32) and the "… enforcement of fishery laws in municipal waters including the conservation of mangroves" (Section 17, as presented in Roldan and Sievert 1993:33). Hence, the municipal governments are expected to both enact and enforce necessary living aquatic resource ordinances and other regulatory measures. The LGC encourages the grouping of local government units as well as cooperation with community and non-governmental organizations to achieve these ends.

While legislation is enacted and enforced by the municipality, the LGC recognizes the *barangay* as the basic political unit functioning as "the primary planning an implementing unit of government programs, projects, and activities in the community" (Tabunda and Galang 1992:I-192). The *lupong tagapamayapa* is headed by the *punong barangay* (chief executive of the barangay government) and has jurisdiction over disputes between parties residing in barangays in the same municipality with certain restrictions (for example, not applicable to offences punishable by imprisonment of more than one year or a fine exceeding 5,000 Pesos, where one party is the government or a public employee and the dispute involves performance of official functions; (see Tabunda and Galang 1992:I-195). The LGC has

expanded the jurisdiction of the *lupon* to include non-criminal cases, referred by the court for amicable settlement (Tabunda and Galang 1992).

Hence, the legislation allows for a great deal of latitude at the local level to adapt CB-CRMs to prevailing conditions and specifically supports the development and use of user organizations in the process. Aspects of the LGC, as realized in the municipal fishery ordinances affecting Calagcalag provide an illustration of the facilitating nature of the legislation at the local level. On June 9, 1993 the Office of the Sanggunian Bayan, Municipality of Ayungon enacted Ordinance No. 5, The Municipal Fisheries Code of 1993. The guiding principles of the legislation, quoted below, clearly indicate an emphasis on resource conservation through community participation:

> Section 1. It is hereby declared the policy of the Municipality of Ayungon to accelerate and promote the development of its fishery resources to optimum productive condition through proper conservation and protection.
>
> Section 2. The municipal government shall encourage the organization of artisanal/municipal fishermen, Bantay Dagat, and the like and provide assistance to integrate the activities of persons, associations, cooperatives and corporations engaged in the fishing industry, so that the municipality may achieve the maximum economic utilization at the same time protecting its fishery resources.
>
> Section 3. The private sector's privilege to utilize the municipality's fishery resources shall be exercised or continue to be exercised only under the basic concept that the grantee, licensee or permittee thereof shall not only be a privileged beneficiary but also an active participant and partner of the municipal government in its conservation and development of the fishery resources of this municipality.

The Ayungon municipal legislation not only allows the formation of user groups, it also encourages their formation through preferential rights to exclusive fishing privileges, such as operating fish corrals, culturing aquatic organisms, and gathering fish fry (*bangus* [milkfish] fry) for culture and propagation purposes. The municipal legislation, drawing on Section 149 of the LGC states:

> While the Sanggunian Bayan may require the conduct of a public bidding when granting fishery privileges, duly registered or accredited organizations, associations and cooperatives of marginal fishermen shall have the preferential rights to such fishing privileges without being required to undergo the bidding. However, in the absence of such organizations, associations and cooperatives, or in case they fail to exercise their preferential rights, other parties may participate in the said public bidding in conformity with Sec. 149 of the Local Government Code of 1991. User groups and/or families can also be granted licenses and responsibility for artificial reef areas.

Section 7 of the legislation states that:

> The Sanggunian Bayan shall encourage and support the fishermen's associations to engage in the construction of the artificial reef which shall be managed and

> protected by the fishermen/Bantay Dagat themselves. A license may be issued to a family who constructed the artificial reef and established the area or to an association whichever is applicable, for better management and protection....

Although existing legislation is facilitating with respect to some aspects of the sustainability of the Calagcalag CB-CRM associated with the CVRP, there are some problems associated with the application of the LGC. Tagarino et al. (1995) conducted a well-reasoned study on the interrelationships between the Local Government Code (R.A. 7160) and the Fisheries Decree (PD 704) and their application to fisheries development and management, as promulgated by a Fishery Sector Program project in Calauag Bay. A summary of their findings is relevant to our interpretation of the efficacy of R.A. 7160 and PD 704 as enabling legislation for CB-CRMs. They clearly make a number of important points:

First, there are inconsistencies between the two laws which could lead to conflict; e.g., PD 704 allows commercial fishing in waters deeper than seven fathoms which in many places overlaps with the definition of municipal waters of fifteen kilometers from the shore. Commercial fishers, when apprehended in municipal waters have used this as an argument in litigation. There are also inconsistencies with regard to penalties. The penalties authorized for violations of fisheries laws are much lower and weaker under R.A. 7160—so low that they would not necessarily deter illegal activities. Finally, although the LGC gives local government territorial jurisdiction over coastal and marine resources, the Bureau of Fisheries and Aquatic Resources (BFAR) still has authority over some types of fishery resources and activities within the local area (Tagarino et al. 1995:13–14). A Memorandum of Agreement (MOA) between the Department of the Interior and Local Government, and the Department of Agriculture was written in 1994 eliminating some, but not all, of the overlapping jurisdictions, but there is some question concerning the legal authority of such a MOA vis-à-vis PD 704. Tagarino et al. (1995), citing Bojos, note that despite a MOA between the Department of Agriculture and CVRP-1 authorizing licensing of artificial reefs, municipal ordinances including these licensing powers have been rejected by BFAR. It should be noted that the Ayungon Municipal Fisheries Code of 1993 authorizes licensing of artificial reef areas.

The Ayungon Municipal Fisheries Code of 1993 (AMFC) also has other areas of potential conflict with PD 704 that may impede enforcement. PD 704 defines vessels over three gross tons (GT) as commercial, in contrast to municipal (3 GT or less). The AMFC defines commercial fishing as:

> ... fishing for commercial or profit purposes in the municipal waters within fifteen (15) kilometers from the shoreline, with or without the use of fishing vessels of any kind, make or size.

Municipal fishermen are defined as:

> … all fishermen within the municipality including organization, associations, cooperatives or corporation, marginal or small scale fisherfolks engage[d] in any fishing activity.

Hence, commercial fishermen seem to be a subset of municipal fishermen. Municipal and/or small-scale marginal fishing appears to refer to another subset of the category of municipal fishers which, incidentally, overlaps with the commercial category. The AMFC defines municipal and/or small-scale marginal fishing as:

> … fishing with or without fishing vessel of any kind by individuals, organizations, associations or cooperatives engage[d] in subsistence fishing which shall be limited to the sale, barter or exchange of marine products produced by himself and his immediate family, for domestic use or consumption, and whose annual gross income from such fishing activity does not exceed fifty thousand pesos (P 50,000) or the poverty line established by NEDA for this particular region and locality, whichever is higher; provided, that those using motorized fishing vessels of any kind or size [are] not included.

When questioned concerning conflicts with PD 704, the mayor stated that the definitions in the AMFC provide him with more flexibility for developing locally appropriate regulations. In conformance with PD 704, however, the AMFC prohibits fishing in municipal waters by vessels greater than three gross tons. Nevertheless, these changes in definition could result in litigation that could impede effective enforcement.

Second, while the LGC devolves a great deal of responsibility and functions to the local governments, the legislation, as well as modifying MOAs, clearly lack budgetary provisions for carrying out expensive operations such as the socioeconomic and resource assessments necessary to develop and maintain effective, sustainable coastal resource management. Also lacking is sufficient support for surveillance and enforcement. Local attempts to impose stiffer penalties (e.g., confiscation of gear) have been denied. Equipment adequate for the demands of surveillance and enforcement is too expensive for poor municipalities to purchase. Vested interests among local officials result in conflicts in law enforcement. Finally, lack of close coordination of *barangay* fish wardens and police impedes apprehension of violators (Tagarino et al. 1995). All these problems require administrative, technical and financial support, especially in disadvantaged locations. Supporting these conclusions, the mayor of the Municipality of Ayungon noted that they have given him all the responsibility, without the resources to be fully effective.

Summarizing facilitating aspects of formal legislation (both national and municipal) with regard to facilitating the Calagcalag CB-CRM, we find that:

1. The legislation not only permits, but also encourages the formation of user groups.
2. The legislation authorizes (with qualifications) user groups to define boundaries for exclusive access.
3 The legislation facilitates security of tenure for user groups through preferential rights in obtaining exclusive fishing privileges and long-term renewable leases for mangrove areas.
4. The Local Government Code (RA 7160), in combination with The Fisheries Act of 1975 (PD 704) and subsequent PDs, Letters of Instructions (LOIs), and Fisheries Administrative Orders, provide general guidelines within which user groups can devise and legally implement, through their local government, locally appropriate management rules.
5. Although not specifically mentioned in the LGC, provisions for user group participation in formulating municipal legislation, and the local administration's support of this type of participation, can (but will not necessarily) result in recognition and formalization of traditional or informal management systems, where they exist, if they fall within the general guidelines referred to above.
6. It appears that the legislation is inadequate with respect to actually providing supportive structures for resource monitoring, surveillance, enforcement, conflict resolution, and information. As noted, some aspects of the legislation actually generate conflict.
7. The municipal legislation provides for participation of user groups in developing and implementing surveillance and enforcement methods through encouragement and support of the formation of *Bantay Dagat* (voluntary guards of the sea).

Community-Level Coastal Resource Management The community-level coastal resource management variable involves a description of local resource management efforts, both formal and informal. Information can be obtained from key informants and documents, where available. A significant aspect of local governance concerns coastal resource use rights, both formal and informal. Determining local use rights can be relatively straightforward, unless boundaries are illegally maintained (Pollnac 1984). In the relatively straightforward cases, key informants can provide information. Examples of questions that can be posed to evaluate these local efforts are as follows:

1. In terms of the relevant resource are there or have there ever been any restrictions concerning whom has rights to harvest the resource?

2. Are the rights restricted to a) an area or region? b) a particular species? c) use of a particular gear? d) certain recreational activities? e) other (specify)?
3. How long has this system been in effect? If no longer in effect, when was it in effect and for how long?
4. If yes, is there written legislation concerning these rights or are the rights based on an informal agreement?
5. Is there or was there a group or leader to manage and enforce these rights?
6. Who has the right of access and who is excluded?
7. Describe the boundaries in terms of distinctness (Acheson 1988).
8. Is it possible to transfer the access rights (by inheritance, by selling or giving them away)?
9. How would one be caught, if breaking the access rule?
10. What would be the punishment?
11. What is the level of compliance (frequency of violations)?

Other local level management efforts to be evaluated include rules governing collection, harvesting, mining, or modifying any coastal resource. This is a very general category that includes rules governing any type of human behavior that impacts coastal resources. An example of a description of local coastal resource management is presented below.

Example 16: Community-level coastal resource management

The following example of community-level coastal resource management is derived from a post-evaluation of CB-CRM carried out in Calagcalag, a coastal village in the municipality of Ayungon, on the east coast of the Island of Negros in the Philippines (Pollnac et al. 1996).

No informal systems of coastal resource use rights were uncovered in Calagcalag during the research period. All use rights were codified in the appropriate national or municipal legislation as described above. First, in terms of access rights, the national law (PD704) classifies fishers into two groups, commercial versus municipal, on the basis of vessel capacity. Vessels greater than 3 gross tons are classified as commercial. PD704 then notes that commercial vessels cannot fish in municipal waters, first defined as 7 km by PD704 and redefined as 15 km from shore by the Local Government Code. PD 704 also restricts commercial fishers to waters more than 7 fathoms deep. This law effectively gives municipal fishers exclusive rights to municipal waters and waters less than 7 fathoms deep. PD 704 came into effect in 1975 and the LGC in 1991.

The Ayungon Municipal Fisheries Code of 1993 (AMFC) redefines the categories municipal and commercial, as described above, but still prohibits vessels greater than 3 GT from fishing in municipal waters, hence, continuing the use rights associated with PD 704. The AMFC, however, does not mention the 7 fathom restriction.

The Municipality of Ayungon also has formal legislation prohibiting fishing in a sanctuary located off the shore of Calagcalag. In 1989 the Municipality of Ayungon passed a resolution endorsing establishment of a sanctuary with the support of the Calagcalag Fishermen's Association, but attempts to prohibit fishing in the designated area were unsuccessful despite efforts of municipal, *barangay*, and *Bantay Dagat* authorities. Hence, in 1991 an ordinance was passed establishing the sanctuary, prohibiting all forms of fishing and shell gathering, as well as boat anchoring, within 50 meters of the sanctuary boundary, which was to be marked by marker buoys. Snorkeling, scuba diving "and other related marine activities" are also strictly prohibited within the sanctuary. The AMFC of 1993 supports the ordinances regarding sanctuaries, but extends the no fishing boundary to 200 meters beyond the boundary of the sanctuary (Section 8c). The sanctuary ordinance is a restriction on use rights.

Specific exclusive fishing privileges can also be granted by the Sanggunian Bayan of the municipality. Section 8 of the AMFC states that:

> Operating fish corrals, eucheuma seaweed culture, and catching, gathering and taking of "bangus fry" or frys of other species of fishes for culture and propagation purposes shall be considered as exclusive fishery privileges which may be granted by the Sanggunian Bayan to the highest bidder in a public bidding for a period of one (1) year from the issuance of the permit.

Zones for exclusive privilege are designated by latitude and longitude in Section 17 of the AMFC. The legislation goes on to note that preference may be given to certain categories of persons, e.g., organizations of marginal fishers:

> While the Sanggunian Bayan may require the conduct of a public bidding when granting fishery privileges, duly registered or accredited organizations, associations and cooperatives of marginal fishermen shall have the preferential rights to such fishing privileges without being required to undergo the bidding. However, in the absence of such organizations, associations and cooperatives, or in case they fail to exercise their preferential rights, other parties may participate in the said public bidding in conformity with Sec. 149 of the Local Government Code of 1991.

Significantly, Section 8 goes on to state that:

> Any person who is not a grantee of a license or privilege to engage in commercial fishing shall be allowed to fish for domestic use only, in any municipal waters, in case no commercial fishing therein [is] established; provided, however, that in no case shall fishing be allowed within 200 meters from a fish corral, fish sanctuary or any fishing means licensed by the municipality; and provided further, that no fish caught under this privilege shall be sold.

Hence, if the fisher plans to sell all or part of the catch, a municipal license is needed as defined under Section 16 of the AMFC and taking into account the AMFC's definition of commercial fisher. (See page 6 of the document). Section 29 of the AMFC states that fishers of the municipality of Ayungon are given preference for fishing in municipal waters, and implies that outsiders need a permit from the mayor as well as recommendation from the area/zone *Bantay Dagat* or fishermen's association. User groups and/or families can also be granted licenses and responsibility for artificial reef areas. Section 7 of the legislation states that:

> The Sanggunian Bayan shall encourage and support the fishermen's associations to engage in the construction of the artificial reef which shall be managed and protected by the fishermen/Bantay Dagat themselves. A license may be issued to a family who constructed the artificial reef and established the area or to an association, whichever is applicable, for better management and protection....

Finally, in 1990 the national government introduced a 25-year, renewable lease instrument (Mangrove Stewardship Agreement) which is used to grant traditional small-scale mangrove users secure tenure over mangrove areas (Alcala and Vande Vusse 1994). The Department of Environment and Natural Resources has granted these stewardship contracts to individuals participating in mangrove reforestation projects in Calagcalag.

In summary of the foregoing, there is specific assignment of and restrictions concerning coastal resource use rights in Calagcalag. These use rights and restrictions apply to designated areas (for example, municipal waters, exclusive fishery privilege zones), species (for example, *bangus* fry), and gear types (fish corrals, vessels >3GT, etc.). Furthermore, specific classes of individuals receive preferential rights. Boundaries are defined by law, as noted above, and are relatively distinct (marker buoys around the sanctuary, marker stakes around *bangus* fry harvesting areas). This system has been in its present form since the publication of the AMFC of June 1993, which made additions and changes to other legislation cited above.

Continuing with use rights, the AMFC makes no mention of transferring use rights associated with either Section 7 (artificial reefs) or Section 8 (exclusive fishing privileges). The privilege is only granted for one year, suggesting that this may not be an issue. It is conceivable, however, that an individual or group not meeting the preferential rights criteria in Section 8b might request transfer of rights from a group granted the right under the preferential rights criteria. Key informants from the fishermen's association reported that access rights can be transferred to nearest kin, and that they are not allowed to sell to others. The nearest kin must be interested and agree to follow the rules and regulations of the association.

Concerning coastal resource management measures other than use rights, the AMFC sections 20 through 30 parallel much of PD 704 and subsequent PDs,

Letters of Instructions (LOIs), and Fisheries Administrative Orders. Specifically prohibited in municipal waters is:

- Fishing from vessels greater than 3 gross tons
- Using destructive fishing methods (for example, explosives, toxic, obnoxious, and poisonous substances, electricity)
- Discharging or dumping toxic, noxious, and poisonous substances into municipal waters
- Fishing with a net less than 3 centimeters stretched mesh, unless target is smaller than that size when mature
- Gathering or destruction of corals or mangroves
- Use of *muro-ami* or *kayakas* fishing techniques
- Fishing with the use of air compressor or similar devices (except with clearance from appropriate government agencies like the Department of Health, Bureau of Fisheries and Aquatic Resources, Philippine Sports Commission, or the Department of Environment and Natural Resources)
- The taking, catching, gathering and selling of the frys of the siganid family like *ngisi-ngisi*, big bolinao like *sihag-sihag*, and shrimps like *oyap* and *hipon*, both inland and sea water species

Following implementation of the Local Government Code surveillance and enforcement of use rights and other coastal resource management measures was assigned to the local level—the municipality and the *barangay*. Members of the fisher community are involved through the institution of the *Bantay Dagat*, voluntary guards of the sea. Private community members can also inform the head of the fisher's association about violations. Early on, the mayor of Ayungon assigned police officers to go with the *Bantay Dagat* to teach them procedures for apprehension, arrest, and evidence. Members of *Bantay Dagat*, however, complain of lack of resources and time to make the numerous trips to the municipal center if an offender contests the violation and it cannot be settled locally. They also complain that the mayor sometimes seemingly arbitrarily drops a charge.

A guardhouse is supposed to be manned within view of the sanctuary, but during the research no one was visible inside. Another guardhouse was built on pilings over Mantalip Reef (an area frequented by spear fishers from Calagcalag and nearby *barangays*) to monitor for illegal fishing. In the beginning, it was reportedly manned 24 hours a day by Philippine National Police until the LGC and associated devolution of power transferred the duties to the municipal level. Lacking sufficient resources, the guardhouse is now unmanned, and stands as a cement monument to the early efforts at resource management. Reportedly, a Composite Law Enforcement Team (CLET) has been established with participation of BFAR, the

Department of Environment and Natural Resources, as well as municipal police and association members, to deal with these enforcement issues.

Penalties for non-compliance are published as a part of the AMFC and include fines and/or jail sentences. As noted above, PD 704 and subsequent PDs, Letters of Instructions (LOI), and Fisheries Administrative Orders (FAO) also indicate fines and/or jail sentences for non-compliance. According to key informants, the municipal ordinance restricting fishing activities to an area 200 meters from the sanctuary, artificial reefs (ARs), etc., is known by some fishers, but ignored by most, who still honor the 50-meter limit. Other than this institutionalized evasion of a rule, key informants state that the rate of compliance is high.

Coastal Activities

Introduction

Obtaining accurate data on coastal activities is not an easy undertaking. They are usually seasonal and take place out of sight of land at all hours of the night and day. This is one of the most important types of data collected in the baseline, so a multi-method approach, using all the methods listed in the general methodology section should be used. Basically the data will be gathered using techniques identical to those outlined for the preliminary appraisal (see pp. 13–24) except that more time and effort will be involved, and distribution of activities in the population will be determined by use of a sample survey.

The following types of information must be part of the description of each of the various coastal activities in the baseline.

- Significance
- Methods
- Scale of operation
- Tenure and conflict
- Distribution of labor
- Ownership of productive equipment
- Production, income, and marketing

Significance

The significance of a coastal activity refers to its relative importance for the people in the community. This is determined in the occupation section of the sample survey, described above. Each activity must be ranked in terms of its relative importance for each household, and the distribution of these rankings in the sample must be determined. Within certain activities like fishing, there are a number of sub-activities, e.g.,

fishing with different types of gear for different species. The distribution of the different gear types provides information concerning their relative significance, determined by asking what types of gear are used by each household reporting fishing as a productive activity.

Methods

Methods refers to a detailed description of the tools (gear) and their deployment for each activity, best determined through a combination of key informant interviews, observation, and participant observation. Interviews are usually only sufficient for obtaining a preliminary description. Methods, like setting a net, tying a knot, spearing a fish, etc. are often not easily verbalized. Rather, they are stored and recalled as perceptual-motor skills, some of the routine behaviors being unconscious repetitions of activities learned through observation, example and a great deal of practice. Interviews should be followed or accompanied by observation or, even better, participant observation. An attempt should be made to describe all aspects of the activity, since it is difficult for any one individual to know what may be significant in terms of resource management. For example, a description of milkfish fry harvesting might state that fry are scooped out of the larger net with a small dip-net and deposited in a basin from which non-milkfish fry are culled. This description is accurate, but it omits mention of where the non-milkfish fry are culled and what is done with them. Compare it with Pollnac et al. (1997a) who write:

> The fry are scooped from the larger net with the dip net, then placed in a shallow bowl. The milkfish fry in this bowl are then taken to the shore where the fisher's companion waits to sort the desired fry from the other organisms captured. This is done by scooping the milkfish fry from the larger bowl with a small container and dumping them into another container (usually a plastic bucket). The unwanted organisms are then dumped on the sand.

With such a sufficiently detailed description, if the field team does not understand the significance of dumping by-catch on the sand, surely one of the users of the baseline will. Detailed descriptions of coastal activities are essential for precisely this reason.

Scale of Operation

Scale of operation is concerned with size: How large is the net? How many lines and how many hooks on the line? How many crew members on the boat? How large (hectares) is the seaweed farm? All these questions are related to the level of production, and therefore to the socioeconomic status of the producers and levels of exploitation of the resource. This kind of information is derived from survey questions and key informant interviews. In the survey, respondents can be asked how many hectares of seaweed farm they cultivate (or how many lines, how long, and what is the spacing, to calculate area). Key informants can be questioned concerning the sizes (length, width

and mesh) of different types of nets. If sizes remain constant between nets of the same type, respondents in the survey need only be asked what type of net they use.

Tenure and Conflict

Tenure and conflict are concerned with use rights, with respect to the coastal activity in question. There are two types of use rights, de jure (legally written into law) and de facto (what is actually practiced). De jure use rights can be determined from written information, e.g., written legislation, be it local, regional, or national. For example, the Philippines local government code has placed much of the responsibility for managing nearshore waters in the hands of local government at the level of the municipality. Therefore, municipal laws can be drafted concerning use rights in those waters. These laws are written and legally published by the municipality, thus can be reviewed to determine de jure use rights.

Information on de facto use rights can be obtained by a combination of observation and key informant interviews. Observation is essential because information obtained through interview may only reflect ideal, not real, behavior. This raises another point with respect to de facto use rights—they may not reflect de jure rights. There may be laws on the books, but the community may not obey them. Hence, de facto use rights must also be examined for behaviors that disregard legislated restrictions. The distinction between ideal and real behavior looms even more strongly in these cases. Informants often report the de jure use right as what is practiced, especially by people in their own community. Hence, observation must accompany any other method for obtaining information on de facto use rights.

Conflict, in this context, refers specifically to conflicts between users concerning a specific resource or group of resources—for example, conflicts concerning who can fish where or when, and conflicts concerning right of way and fishing rights in aquaculture areas (including seaweed culture). This kind of information is also best obtained through key informant interviews, supplemented by observation.

Distribution of Labor

An examination of distribution of labor entails determining the social category of the individual or individuals who perform the activity in question. The minimum social categories to be determined are sex and age (adult or young person). In some cases it might be necessary to break age into more categories than two, to include children, adolescents, adults and elderly, especially when one of these categories is a significant component of a particular coastal activity. Observation and key informant interviews will determine which categories are important. Distribution of participation by the different social categories in the various coastal activities is best accomplished with the social survey. As part of the survey, respondents can be asked to report the total number of household members in the different social categories involved in each productive activity.

Ownership of Productive Equipment

Ownership of productive equipment is useful in determining the social structure of coastal activities, since owners usually receive a greater proportion of the production and have higher social status in the community than non-owners. Ownership can be determined through surveys in which respondents are asked what type of equipment they use, as well as whether or not they own it.

Production, Income, and Marketing

Production, income, and marketing are a set of interrelated variables referring to the output of coastal activities. This information is generated by obtaining answers to the questions of what is produced, in what quantity, what it costs to produce it, what type of processing (if any) is done, what it is worth, and where and how it is sold. Most of these questions are most efficiently answered through interviews with key informants, although target species can be determined with a question on the survey instrument. This is especially important with activities like spear fishing, hook and line fishing, or the use of relatively small gill nets, methods that usually target a relatively large variety of species within the same community.

Two examples of baseline information on coastal activities are provided, one for seaweed culture and one for fishing. The seaweed culture example examines an activity that directly and immediately alters the coastal ecology (human and non-human) by taking up space with lines, stakes and floats, altering navigation possibilities, and changing the relative abundance of species, by increasing the amount of certain types of seaweed and the organisms that feed on it. The fishing example demonstrates the complexity of this activity, as manifested in an area characterized by multiple types of fishing. The production, income, and marketing section of the fishing example has been shortened to include only one type of fishing. The examples are drawn from a baseline conducted in North Sulawesi (Pollnac et al. 1997b).

Example 17: Seaweed farming

Significance Extensive seaweed farms totaling 170 ha (this is not the exact area of cultivation as there are many channels and uncultivated space between individual farm plots) are set in water beyond the reef flats between Popaya Point and Bentenan Village, within most of the interior of Sompini Bay (some Sompini residents also farm seaweed in the bay), and on the large reef flat north of Bentenan Island. Most of these farms tend to be in deeper water of 3 to 8 m depth, compared to other areas of North Sulawesi, where seaweed is typically cultivated over shallow reef flats.

Seaweed farming contributes to the income of 35 percent of the sample from the coastal *dusuns* of Bentenan and 23 percent of the Tumbak sample. None of the

residents of the inland *dusuns* of Bentenan in our sample practice seaweed farming. None rank seaweed farming as the primary source of income; it is most frequently ranked as second or third (Table 10).

Cultivation methods Seaweed farming was only recently reintroduced to the Bentenan/Tumbak area in 1996. Relatively dense plantings are found just offshore from Bentenan *Dusun* 3, over the reef flats north and west of Bentenan Island, and on the east side of Cape Popaya, throughout Sompini Bay, and offshore to the east and southeast of the residential area of Tumbak. In all these areas, the waters are so dense with the multicolored plastic bottles used as floats for the seaweed culture lines that navigation is difficult without a local guide.

Table 10: Distribution (%) of rank of importance of seaweed farming

Rank	Coastal Bentenan	Tumbak
1	—	—
2	10	18
3	19	05
4	—	—
5	06	—
Total	**35**	**23**

Off Tumbak, some seaweed is cultivated in large areas fenced off from the open sea by netting. It was reported that when seaweed farming began in 1996, there were some initial problems with rabbitfish, but the amount of seaweed cultured now reportedly overwhelms the rabbitfish. Additionally, the placement of some culture areas in waters deeper than those traditionally inhabited by grazing rabbitfish has reduced the problem.

In both Bentenan and Tumbak, seaweed is cultured above coral, sandy bottoms, and seagrass beds. In shallow water, stakes are driven into the bottom and lines are stretched between the stakes. In deep water, lines are anchored to the bottom with large rocks, and surface floats connect the lines on which the seaweed is cultivated. A small seaweed cutting (a bud) is tied at approximately every 0.25 m along the length of line. Each of these knots produces between 1 and 4 kg (wet weight) seaweed at the end of a three-month growing period. Some harvest after only two months, producing less seaweed. This variation is attributed to planting location and weather, a subject needing further research. Observations of several harvests along the beach indicate about a 2 kg modal weight.

Scale of operation Length of lines and spacing varies. Pooling the data from both villages, line length varies between 19 and 100 m (mean = 69.7, sd = 27.7) and spacing between lines varies from 0.5 to 10 m (mean = 2.7, sd = 2.6). The

total area covered by each household varies from 240 to 7000 m^2 (mean = 2490.1, sd = 1736.0). Differences in average area between Bentenan and Tumbak are not statistically significant (means = 2458.2 and 2533.9 m^2, respectively; t = 0.091, p > 0.05). Distribution of seaweed area between households can be seen in Table 11.

Sea tenure and conflict There is apparently relatively open access to sea areas for seaweed culture. Seaweed farmers are required to have a permit from the Fishery Department (*Dinas Perikanan*), and the only restriction reported is that they cannot block navigation channels used by power boats. Non-powered vessels can apparently thread their way through the plantings. Although permission from the fisheries department is legally required, in actuality, no one has a permit or permission letter from the fisheries department. It is reported that *Dinas Perikanan* have come down on occasion asking about the absence of permits, and the *Kepala Desa* fends them off saying the seaweed farming areas are not private businesses (corporate farming) but just village people cultivating very small plots. He has argued that no permit from fisheries is needed, just as no license is obtained by small-scale fishermen in small boats.

Table 11: Percent distribution of seaweed culture area

Area (m^2)	Bentenan	Tumbak	Total
<1000	18	25	21
1000–1900	36	13	26
2000–2900	18	—	11
3000–3900	—	50	21
4000–4900	18	13	16
>5000	09	—	05
N	**11**	**08**	**19**

Farmers do get permission from the *Kepala Desa* before establishing a plot, and he makes sure that channels are maintained for boats, and that no claims conflict with existing farm plots. The first claimant for a specific area gets it, but if there is no apparent cultivation activity, someone else can claim the area. Reportedly, this has never happened. Further, there is no reported conflict between seaweed farmers and fishers; many of the seaweed farmers are also fishers. Additionally, some of the inshore fishers use the seaweed farming area as a fish aggregating device. Almost any day one can see inshore gillnet or handline fishers deploying their gear adjacent to or between the seaweed culture lines. One seaweed farmer reported that he opportunistically spears rabbitfish when tending his seaweed crop.

Distribution of labor In the sample households, seaweed culture is carried out by adults and children of both sexes. The analysis of data from both communities combined indicates that in 42 percent of the sample households, seaweed cul-

ture is carried out by adult males only. Both adult males and females perform this productive activity in 42 percent of the households. In 11 percent, adults of both sexes and young females do the work, and in 5 percent, adults of both sexes and young males. As can be seen in Table 12, the two communities are quite similar in the distribution of labor by age and sex with respect to seaweed culture.

Production, income, and marketing Seaweed culture has an appreciable impact on household income, as evidenced by its rapid adoption by residents of Tumbak and Bentenan. An example from one key informant from Bentenan can illustrate the income potential. This individual cultivates seaweed in an area approximately 40 by 100 m. He reports that each knot produces 1kg (wet) per harvest (every three months, but Bentenan has to skip one three-month period due to weather; Tumbak has four harvests per year). A 60 *depa* line (1.6 m per *depa* or arm span) has 400 knots per line. A 40-m width has ten lines (four-meter spacing) resulting in 4,000 knots or a 4,000-kg (wet) harvest. One kg wet sells for Rp 250, so 4,000 kg earns Rp 1,000,000 three times a year for this seaweed farmer in Bentenan, or an annual income of Rp 3 million from the seaweed. It should also be kept in mind that 1 kg per knot per harvest is at the lower end of reported growth. Several farmers reported 2 and 3 kg per knot per harvest, suggesting a potential for two to three times the income for the same size and density of planting. This income is said to be more certain than fishing. Since seaweed culture is only one of several household productive activities, farmers frequently plant and harvest individual lines at different times, so that the work and income is staggered, allowing time for other activities.

Table 12: Percent distribution of seaweed culture labor by sex and age in sample households

Age and Sex Status	Bentenan	Tumbak
Adult males	36	50
Adult males and females	45	38
Adult males and females & young males	09	—
Adult males and females & young females	09	13

The seaweed harvest is dried and sold for 750 Rp/kg. Dry weight is reportedly one-third that of wet weight. The middleman sells it for 850 Rp/kg to a buyer who comes from Manado for distribution in the world marketplace. Reportedly, there are two buyers in Bentenan, and prices are going down. At the beginning in 1996, producers were paid 800Rp/kg (dry), but at the present time (June 1997) only 750Rp/kg.

Example 18: Fishing

Significance The capture fishery plays a significant role in the life of the people of Bentenan and Tumbak. The beaches of both communities are lined with fishing vessels, and some sort of fishing activity is going on at all hours of the day and night, as evidenced by the departure and arrival of boats and their activities in the inshore and offshore areas. The occupation of fishing contributes to the income of 85 percent of the households in Tumbak, 83 percent in coastal Bentenan, and 10 percent in inland Bentenan (see Table 13). It is the most important source of income for 70 percent in Tumbak and 71 percent in coastal Bentenan. (Gleaning, ornamental fish collection, and milkfish fry collection are edited out of this section to conserve space. That which remains is more than sufficient as an example. The reader is referred to Pollnac et al. [1997b] to see information concerning the other fishing types.)

Table 13: Percent distribution of the relative importance of fishing

Rank	Bentenan		Tumbak
	Coastal	Inland	
1	71	—	70.0
2	03	10	07.5
3	03	—	05.0
4	06	—	02.5
Total	**83**	**10**	**85.0**

Fishing vessels Several types of boats are used by the fishers of Tumbak and Bentenan. The simplest is the *bolotu*, a dugout canoe, usually 3 to 6 meters in length, rarely motorized. A large (c.10 meter), motorized version of the *bolotu*, which is used to deploy certain types of nets is present, but in limited numbers. The *londe* is a beautifully carved dugout, double outrigger, with gracefully curved projections at the base of the bow and stern. The projection at the base of the bow can be anywhere from one-third to two-thirds of a meter long, 8 to 10 cm high, and 6 cm thick. The projection at the stern is shorter. *Londe* are rarely motorized. The most common vessel in Tumbak/Bentenan is the *pelang*. The *pelang* is also a dugout, double outrigger, but it lacks the graceful carving and projections at the base of the bow and stern that characterize the *londe*. Many *pelang*, especially the larger ones, have plank extensions to increase the depth of the dugout hull. The *pelang* also encompasses a wider range of sizes (from 2.5 to 12 or more meters in length), with the larger ones frequently motorized. *Pajeko* refers to a mini-purse seine net, but p*ajeko* is also the term applied to the vessel that deploys the net. The

pajeko is the largest fishing craft used by the fishers of Bentenan (no Tumbak fishers own a *pajeko* at the present time), averaging about 16 to 20 m long, 4 m wide, and 2 m deep. They are usually powered by two to three 40 hp outboard motors. *Sope* is the term applied to a relatively large boat (hull about the same size as the *pajeko*), which was originally used by the nomadic Bajo when they lived on their boats. Only one of the sample households uses this type of vessel. Table 14 represents a vessel count made during a preliminary appraisal conducted in March 1997, and Table 15 provides the percent distribution of households whose members fish from the various categories of vessels.

Table 14: Vessel counts, March 1997

Vessel Type	Tumbak	Bentenan
bolotu	—	36
londe	03	04
pelang no motor	51	33
pelang motorized	11	21
pajeko	04	—

Table 15: Percent distribution of boat-using households using different vessel types

Vessel Category	Tumbak	Bentenan
bolotu	26	—
bolotu with motor	09	—
londe	03	—
pelang, small no motor	20	75
pelang, medium no motor	11	04
pelang, medium motorized	26	14
pelang large motorized	37	07
pajeko	—	18
sope	03	—
motorized transport boat	03	—

Notes: Columns may sum to more than 100% as fishers may fish from more than one boat type. Small = < 5m long; medium = > 4.99 m long and < 1 m wide; large = >4.99 m long and > 1 m wide.

Fishing gear A wide range of gear types is used in the Bentenan/Tumbak fishery. Perhaps most common and most widespread is the hand line. Hand lines are usually deployed from a *londe* or *pelang*, but can be deployed from any type of boat or from the shore. Hook size and number depend on target species. In most cases some form of bait is used, but lures designed for specific fish are also deployed, some carved from wood and others made from bits of frayed colored plastic line.

A relatively rare type of line fishing, kite fishing (*pancing layang layang*) was observed just off Bentenan Island. Reportedly, two fishers from Tumbak practice this activity. The line is attached to a kite made from the leaf of an epiphytic plant that grows on mangrove trees. The leaf is about 35 by 25 cm, and as a kite, keeps the line suspended over the water several tens of meters from the boat. These fishers target garfish.

The gill net is also commonly used for small-scale fishing. In the Bentenan/Tumbak area the general term applied to the gill net is *pukat kalenda*.[1] It consists of one or several pieces of monofilament nylon netting. If several pieces are used, they are sewn together forming a net that can be longer, deeper, or both. The size of each piece is related to mesh size, which is related to target species. Piece sizes range from 25 by 2.25 m to 35 by 4 m and mesh sizes used range from 1.5 to 3 inches. Floats are attached to the top of the net and weights to the bottom. A piece of net 30 by 3 m requires about 250 (5–7 cm diameter) floats cut from the same material used to make the sole of relatively cheap sandals (flip-flops) and 5 kg of sinkers. Large stones are used as the main weights at either end. A gill net can be operated in many ways, depending on its target. It can be deployed without the use of a boat in the nearshore waters, over the seagrass beds or near the coral reef flats. With a boat it can be deployed next to seaweed plantings (which act like a fish aggregating device), adjacent to coral reef structures, or anywhere target fish are known to school or move about. The net can be set at the surface either drifting or fixed, mid-water or at the bottom of the sea. It can also be used actively to encircle schooling fish at or near the surface. Fishers can then frighten the fish into the net by slapping the water with sticks, oars, or their hands, or diving into the water and herding the fish while swimming around and making noise. The technique where fish are scared into the net is often referred to as *soma paka paka*.

Purse seines, although not as numerous as handlines and gill nets, are important because of their larger catches and the number of people employed per unit of gear. *Soma giop* is an older form of purse seine that is being replaced by the *pajeko* in North Sulawesi (Mantjoro and Yamao 1995). The *giop* is more numerous in the Tumbak/Bentenan area (ten reported in Tumbak and two in Bentenan), while only four *pajeko* are operated by fishers in Bentenan. The small number of purse seines, however, can be misleading in terms of impact. Considering that the crew for a *giop* can be between 9 and 15 (12 is ideal), and for a *pajeko* between 15 and 20, the boats can provide employment for 168 to 260 fishers. Both the *pajeko* and *giop* nets have a total length of about 300 m. The *giop*, however, is much shallower—about 20 meters versus the usual 60-meter depth of the *pajeko*. Although the *pajeko* can

[1] Also referred to as *soma kalenda* or *jaring kalenda*.

be set around any school of fish in water of appropriate depth, the *pajeko* of Bentenan usually fish schools that have been aggregated by light boats. Light boats are *pelang* with 6 to 10 pressure lanterns (ideally with reflectors), which go out to sea during night, ahead of the *pajeko*. The light boat signals, with blinking lights, when a school of fish has been aggregated, and the *pajeko* comes to set the net around the fish. They can also set their net around schools of fish aggregated by fish aggregating devices (described below) which are deployed only during a limited time period at Bentenan.

Giop are deployed from large, usually motorized *pelang* (10 to 12 m long and a meter or more in width). The *pelang* usually goes to sea and searches for schools of target fish. Where areas of migration and schooling are known, the *pelang* will sit in the water and wait until a school appears. When one appears, the net is deployed across the line of movement and long lengths of bamboo with colored (usually white, but sometimes blue or pink) plastic streamers are shaken over and on the water to herd the school of fish into the net.

Another type of seine net deployed is the *tagaho,* with seven reported in Tumbak and none in Bentenan. The *tagaho* has a bag of approximately 4 m diameter with wings about 100 m long (total length about 204 m). The depth of the wing decreases from about four meters at the bag to about two meters at the end. It is designed to encircle schooling bait fish. Fish are diverted into the bag section at the center while the fishermen are pulling both wings on the boat. Up to four fishermen control the net and the fish in the water while four to five remain on the boat to deploy and retrieve the net.

The only bag net (*cang*) in use in Tumbak is a big one, 10 m by 10 m, approximately 7–8 m deep, which is deployed from a large *bolotu*. When deployed in deep water, a compressor is used by the diver(s) who herd or scare fish into the bag. It is usually set on or near a reef. Crew size is relatively large at 24 boats, with five crew in each.[2] Other nets reported include *sibu-sibu* (a small dip net), shark nets, and small mesh nets for ornamental fish. In Tumbak, fish traps (*igi*) are also used. Woven like baskets, *igi kepiting* are used for crabs in the mangrove, and *igi ikan* (of varying size with one entryway) are used for both food fish and ornamentals. The size of the trap is related to the size of the target fish.

Harpoons and spearguns are also used. The *tombak* is either a two- or three-pronged, barbed device attached to a 1.5 to 2 m shaft. Fish are speared from the surface, either from a boat or while the fisher is standing in the shallows. Another type of harpoon (*lot turturuna*) has a detachable barbed point that is attached to a line that holds the prey. The approximately 1.75 m shaft, onto which the barbed

[2] *Cang* in other areas of Minahasa have been observed using one very large *bolotu*.

point is attached, has a socket at its base, and the barbed point has a projection which fits into the socket. A thick sheet of lead is wrapped around 45–50 cm of the shaft, adding weight. As its name denotes, it is used for turtle, and the weight ensures penetration of the shell. The technique (according to the interviewee) spread from Bajo fishers living in Gorontalo. There are also spearguns (*jubi*) which are used by underwater divers. The gun is carved from wood and looks and handles like a slender rifle with a trigger. The power is provided by a length of rubber cut from an innertube. Spears are steel rods, approximately 0.8 cm diameter with a toggle barb made from a bent nail inserted through a slot cut into the spear. A notch near the base of the spear engages the trigger mechanism. Spears are of varying length (one to two meters) depending on the target fish. Spear fishers usually dive from *londe* or *pelang*, but they can swim out to the reef from the shoreline. Goggles, carved from wood with glass eyepieces, are used to improve underwater vision.

Fish aggregating devices (FADs locally referred to as either *rumpon* or *rakit*) are constructed and deployed by fishers from Bentenan in the waters of Bentenan up the coast to Rumbia at depths of 30 to 60 *depa* (1 *depa* = approximately 1.6 meters) during the months of July and August. These FADs are deployed mainly for the *pajeko* fleets from the villages between Bitung and Belang. *Pajeko* fishers from the villages along this strip of coastline congregate at the FADs off Bentenan, waiting for aggregations. One resident reported that it looks like a bus stop, with 30 to 40 boats, lights blazing, waiting offshore. These FADs blow away in the storms that occur between October and December, but one good catch from a FAD can bring a profit to the fisher who deploys the device.

Both blast-fishing, using explosives to stun or kill fish and/or extract them from hiding places in reefs, and poison fishing, used only to stun fish and/or extract them from their hiding places in the reefs, are rumored to be practiced in the Bentenan/Tumbak area. During the collection of data for this report, five certain and four questionable blasts were heard. One blast struck the underwater survey team with such force that it broke the slate on which data was being recorded. Both types of fishing are illegal, and fishers from each community blame the other. Percent distribution of usage of the various gear types among households involved in the capture fishery can be found in Table 16.

Ownership of productive equipment Percent distribution of vessel ownership among fishers in sample households using different vessel types can be found in Table 17. In general, it appears that smaller boats tend to be owned by users. Larger motorized *pelang* and *pajeko*, usually deploying labor intensive gear such as purse seines, tend to be owned by someone other than the fisher in the sample, since there are more crew members than owners.

Table 16: Percent distribution of gear types used among sample households in the capture fishery

Gear Type	Tumbak	Bentenan
Hand line	54	78
Gill net	20	11
Seine net (*giop*)	43	04
Purse seine (*pajeko*)	—	19
Seine net (*tagaho*)	26	—
Shark net	03	04
Dip net (*sibu-sibu)*	—	04
Speargun (*jubi*)	09	—
Harpoon (*tombak*)	03	04
Light boat	—	11
Compressor	03	—

Note: Columns may sum to more than 100 percent due to household's multiple gear use.

Table 17: Percent distribution of boat ownership among boat-using households using different vessel types

	Tumbak		Bentenan	
Vessel Category	No.	%	No.	%
bolotu	9	89	—	—
bolotu with motor	3	100	—	—
londe	1	100	—	—
pelang, small no motor	7	100	21	95
pelang, medium no motor	4	100	1	100
pelang, medium motorized	9	44	4	100
pelang large motorized	13	15	2	100
pajeko	—	—	5	0
pamo	1	100	—	—
sope	1	100	—	—
motorized transport boat	1	100	—	—

No. = total number of families using indicated boat type; small = < 5m long; medium = > 4.99 m long and < 1 m wide, large = > 4.99 m long and > 1 m wide; % = percent of using families that own the boat

Percent distribution of gear ownership by type of gear, in households using the gear type, can be found in Table 18. Again, it appears that the most expensive and labor intensive gear types are the ones least likely to be owned by those using them, due to the fact that there is a higher probability that a fisher in the sample is a crew member, rather than an owner.

Table 18: Percent distribution of gear ownership in households using it

Gear Type	Tumbak No.	Tumbak %	Bentenan No.	Bentenan %
Hand line	19	95	21	100
Gill net	7	100	3	100
Giop (seine net)	15	13	1	100
Pajeko (purse seine)	—	—	5	0
Tagaho (seine net)	9	44	—	—
Shark net	1	100	1	100
Sibu-sibu (dip net)	—	—	1	—
Net for ornamentals	1	100	—	—
Trap for ornamentals	1	100	—	—
Jubi (speargun)	4	100	—	—
tombak (harpoon)	1	100	1	100
Light boat	—	—	3	100
Compressor	1	100	—	—

No. = total number of families using the indicated gear
% = percent of using families owning the gear

Distribution of labor Users of gear by age and sex categories in Tumbak can be found in Table 19, which makes it clear that, for the most part, the capture fishery can be characterized as male-dominated. Adult males dominate fishing crews and the fishing activity. A notable number of adult females participate in *giop* and *tagaho* crews. Fewer participate in gill netting and hand lining. It is interesting to note that in our sample, all the female participation in the capture fishery occurred in Tumbak households.

Table 19: Percent distribution of labor by age and sex categories for each gear type

Gear Type	Adult Males	Adult Male & Females	Adult & Young Males
Hand line	90	5	5
Gill net	70	10	20
Giop (seine net)	81	19	—
Pajeko (purse seine)	100	—	—
Tagaho (seine net)	67	33	—
Shark net	100	—	—
Sibu-sibu (dip net)	100	—	—
Jubi (speargun)	100	—	—
Tombak (harpoon)	100	—	—
Light boat	100	—	—
Compressor	100	—	—

Production, income, and marketing In this section, we examine typical production of important fishing gear types (for brevity, only the *giop* will be discussed in detail), processing where significant, crew structure and distribution of income, marketing and trading. Fish trading is ranked first in contribution to household income by 12 percent of the households in Bentenan and 15 percent in Tumbak. Though fish processing is not ranked first in either sample, 22.5 percent of the Tumbak sample rank it second, 5 percent fourth and 5 percent fifth. In Bentenan, 2 percent rank fish processing third and 12 percent rank it fourth in terms of contribution to household income. In both communities, fish trading is more likely to be practiced by adult female household members, while fish processing is most often carried out by both adult male and female household members. Details concerning distribution of labor in fish processing and trading by sex and age can be found in Tables 20 and 21.

Table 20: Percent distribution by age and sex for fish processing labor

Sex and Age Status	Tumbak	Bentenan
Adult male	23	17
Adult female	—	17
Adult male and female	69	67
Adult female and young female	08	—

Table 21: Percent distribution by age and sex for fish trading labor

Sex and Age Status	Tumbak	Bentenan
Adult male	13	07
Adult female	67	53
Adult male and female	20	40

Turning first to seine net fishing, the *giop* provides a great deal of employment and income in Tumbak. There are approximate seasons associated with this gear. January through April, when the north wind blows, is the *roa* (halfbeak, *Hemirhamphus sp*.) season. May through August, when the south wind blows, is the *deho* (mackerel) and *cakalang* (skipjack) season. September through December is low season, but the *giop* can still catch something.

During the low period, the average is approximately two boxes (70 kg each) a trip, but sometimes as many as 10. A good catch is 10 to 15 boxes of skipjack or mackerel, usually worth between Rp 800,000 and Rp 1,200,000 (10 to 12 boxes). Depending on the market, prices as low as Rp 10,000 or as high as Rp 125,000 per

box were reported by the fishers. For *roa*, high catches are up to 25 boxes (20,000 pieces), but a normal catch is one-tenth that amount, or 2,000 pieces. When the season is right, good catches can be had every three to four days. *Giop* fishers report that in the past there were more fish to catch, but that the price was so low (poor marketing) they put less effort into fishing and did not catch as much as they could. In the past, they report, they could fish in front of Tumbak; now they have to go out farther. They also noted that in the past they could fish with oars, but that now they need a motor to get to the good fishing area. They claim that there are fewer fish today, and that they do not know why; they have to look more and spend more time, but with motors they can do it.

In terms of income, the share system reported indicates that costs are deducted from the gross, then one-half goes to the gear (net) and one-half to the boat, motor and crew. If there are 10 crew, 12 shares are made with two going to the boat and motor. There is no extra share reported for the captain in Tumbak (verified by several *giop* fishers). Costs average 25,000 Rp/trip, if the fishing is conducted in the local area. If conducted as far away as Kema or Basaan, costs are roughly doubled to about Rp 50,000. The crew is paid directly for the catch. The owner processes the *roa*, so he takes his share and pays the crew members Rp 75 for each fish in their share.

An example of the application of this share system is provided for the *roa* fishery, which is complicated by processing, making it more interesting. With an average catch of 2,000 *roa* worth (at 75 Rp/piece) Rp 150,000, subtract Rp 25,000 trip costs (Rp 125,000) divided by two (Rp 62,500) to be shared by the crew and boat/motor. With a crew of ten, plus two shares for the boat/motor, each share is 62,500 divided by 12 = Rp 5,208.33. The high catch (20,000 pieces) would yield more than ten times that amount, or Rp 61,458 per crew member.

The owner, for his part, converts the good catch of roa into 100 processed packages worth Rp 2,000,000. A good catch of 20,000 pieces is smoked for two days—reportedly using 1.5 m^3 of wood at a cost of Rp 12,000 (cost of fire wood is reported to be Rp 4000 per ? cubic meter) and packed in *gepe* (containers made of bamboo). One piece of bamboo (100 Rp/piece) makes four *gepe*. To make 100 *gepe* would take 25 pieces of bamboo costing a total of Rp 2500. Each *gepe* holds 200 pieces of *roa*. 20,000 pieces would make 100 packs which would be worth Rp 2,000,000 (Rp 20,000/*gepe*). If a crew is fishing some distance from Tumbak, they will stay in the area, process, and sell the fish there, making their own *gepe* on the spot. The normal catch of 2000 *roa* would translate into 10 *gepe* worth Rp 200,000. The owner/processor's costs (if he owns the boat, net and engine) are the Rp 614,580 paid to the crew for their share of the *roa*, plus Rp 25,000 trip costs, plus fuel for smoking (Rp 12,000) and the cost of the *gepe* (Rp 2500 for materials),

totaling Rp 654,080. The owner considers the labor involved in smoking and *gepe* construction free, though a good economist would not. Hence, a big catch results in an apparent profit of Rp 1,345,920. This, of course, does not take into account vessel and gear costs, depreciation, or maintenance.

The gear is quite expensive. Total cost to construct the size of *giop* normally used in Tumbak is Rp 6 to 7 million. Together, the boat and motor cost approximately Rp 6 million. Periodic maintenance includes a monthly dying and hardening of the net by soaking it in a red-brown (actually blood-colored) dye made from four 40 kg bags of red mangrove bark soaked in ten gallons of water. The soaking is done in a *bolotu*. Other routine types of maintenance (engine tune-up, net repair, vessel painting, vessel hull and accessory repair) are also performed. Much of the cost for this maintenance, other than material, is time spent by the owner, his family and crew members. Research to calculate these costs has not been done.

Marketing of the catch from *giop* is variable, depending on species caught. For example, *deho* (mackerel), is usually sold to the *tibo-tibo* in Tumbak, but sometimes it is landed at the fish landing center (TPI) in Bentenan where it is auctioned to *tibo-tibo* from Bentenan. C*akalang* (skipjack) is often landed at Belang. *Roa* is smoked and packed in the village and sold in outside markets (Manado and others). (Detailed descriptions of production, income, and marketing for other gear types have been omitted for brevity. To review, see Pollnac et al. 1997b).

Perceptions of Resource Impacts from Human Activities

It is essential to understand individual perceptions of factors influencing the status of coastal resources before attempting to involve people in community-based management. This understanding can be used to identify the distribution of faulty, as well as accurate perceptions. The knowledge regarding these distributions can then be used to structure interventions designed to involve the community in the management of its resources, and to evaluate the changes resulting.

Throughout the past century of behavioral science research, numerous techniques have been developed to assess attitudes, beliefs, and values. The techniques range from asking open-ended questions to posing a series of statements with which the respondent is asked to express a degree of agreement or disagreement.

While the construction of open-ended questions is relatively straightforward, the analysis of the wide variety of responses obtained can be complex. For example, if you ask 100 individuals an open-ended question you may receive 50 or more distinct responses. For example, each respondent may provide one, two, three or more reasons why a person breaks a certain rule. With a sample of 100, the number of distinct responses rapidly builds to a fairly large number. All these responses provide relatively rich and useful detail, but for

statistical analysis it may be necessary to reduce the number somehow. In almost every case, a careful examination of the responses will indicate that they are not totally distinct, but that groups of them share some component of meaning or attribute. For example, if fishers are asked why they use a certain method, different ones may respond, "there are fewer fish," "it is harder to find fish," and "the fish are farther apart now." While somewhat distinct, all these responses share the attribute of lower fish density.

The use of a series of statements to which the respondent expresses different degrees of agreement or disagreement is also complex, despite the fact that the response is already categorized. Of course, each statement can be analyzed separately, but that type of analysis ignores the fact that the statements being asked and analyzed were selected because they are assumed to share attributes related to perceptions of the impact of human activities on resources. We cannot simply sum the responses because the different statements may not all share the same attributes. Even if they share the same attributes, we cannot assume that each statement should be weighted the same in terms of the shared attribute we are trying to measure. For these reasons, some analytical technique should be applied to determine the components of meaning shared by the different statements, as well as the degree to which each statement reflects each component. In other words, some technique of scale analysis must be applied to this type of data. Principal component analysis is frequently used to construct scales from this type of data.

The examples below illustrate the analysis of both types of questions. The first example is drawn from the baseline conducted in Bentenan and Tumbak (Pollnac et al. 1997b) and the second from the baseline and control sites for Bentenan and Tumbak (Pollnac et al. 1998). In the examples, comparisons are made between the various villages. These comparisons are identical to those that can be used to compare the same village at different time periods to determine impacts of project interventions.

Example 19: Perceptions of resource impacts from human activities—attitude scale construction

As one means of obtaining some information concerning community members' perceptions of the coastal resources and potential human impacts on these resources, the sample of household members from Bentenan and Tumbak were requested to indicate the degree of their agreement or disagreement with ten statements. The following 10 statements were used, each of which involves some aspect of relationships between coastal resources and human activities.

1. We have to take care of the land and the sea or they will not provide for us in the future.
2. Fishing would be better if we cleared the coral where the fish hide from us.
3. If our community works together we will be able to protect our resources.

4. Farming in the hills behind the village can have an effect on the fish.
5. If we throw our garbage on the beach, the ocean takes it away and it causes no harm.
6. We do not have to worry about the air and the sea; God will take care of it for us.
7. There is a limit to the amount of seaweed farming that can be done in this area.
8. Unless mangroves are protected we will not have any small fish to catch.
9. There are so many fish in the ocean that no matter how many we catch, there will always be enough for our needs.
10. Human activities do not influence the number of fish in the ocean.

The statements were arranged so as to limit interference between similar statements (statements numbered 9 and 10 were separated by six other statements). It will also be noticed that agreement with some would indicate an accurate belief, while agreement with others would indicate the opposite. This was done to control for responses where the respondent either agrees or disagrees with everything. Statements were randomly arranged with respect to this type of polarity. Respondents were asked if they agree, disagree, or neither (are neutral) with respect to each statement. If they indicated either *agree* or *disagree*, they were asked if they agree (disagree) strongly, agree (disagree), or agree (disagree) just a little with the statement. This resulted in a scale with a range from one to seven. Polarity of the statement is accounted for in the coding process, so as a score value changes from one to seven it indicates an increasingly stronger and more accurate belief concerning the content of the statement. Percent distribution of responses to the statements for Tumbak and Bentenan are in Table 22.

Table 22: Percent distribution of scale values for Bentenan and Tumbak

Statement No.	Scale Value one		two		three		four		five		six		seven	
1	—	—	06	—	—	—	18	*09*	05	*13*	45	*54*	26	*25*
2	03	—	11	*07*	03	*02*	23	*16*	—	—	33	*59*	27	*16*
3	—	—	—	*04*	—	—	06	*02*	03	*05*	61	*75*	30	*14*
4	06	—	35	*32*	—	*07*	39	*45*	02	*02*	17	*14*	02	—
5	14	*05*	32	*41*	06	*04*	17	*04*	02	*07*	18	*38*	12	*02*
6	18	*11*	44	*46*	—	*02*	06	*13*	02	—	17	*25*	14	*04*
7	03	*02*	11	*04*	—	—	35	*13*	—	*09*	36	*73*	15	—
8	—	—	08	*04*	—	—	29	*18*	06	*05*	39	*61*	18	*13*
9	17	*02*	45	*75*	03	*04*	23	*09*	02	*02*	11	*09*	—	—
10	05	*05*	47	*57*	—	*05*	29	*18*	—	—	17	*14*	03	—

Note: Italicized table entries are for Tumbak (N=56). Normal entries are for Bentenan (N=66).

The italicized columns are the percent of scale value for Tumbak in contrast to Bentenan where the typeface is normal. Note that the sum of the rows for either village may not equal 100 percent, due to rounding of table entries. It is clear that there are some faulty beliefs concerning relationships between the coastal resources and the human activities that are included in all 10 statements. The majority of the inaccurate perceptions are related to relationships between the health of coastal resources and farming the hills (statement 4), throwing garbage on the beach (statement 5), and God's influence (statement 6), as well as the possibility of over-harvesting the fish in the sea (statements 9 and 10). In general, the results for Tumbak and Bentenan are quite similar except that residents of Tumbak appear to be more likely to have low scale scores on statements 9 and 10.

A statistical analysis of these differences, however, indicates that the differences are not statistically significant. Sixty-five percent of respondents from Bentenan have a scale value of three or less on statement 9 versus 80 percent from Tumbak. This difference is not statistically significant (Chi-square = 3.48, $p > 0.05$). Fifty-two percent of the respondents from Bentenan have a scale value of three or less on statement 10 versus 68 percent from Tumbak. Once again the difference is not statistically significant (Chi-square = 3.34, $p > 0.05$). Summed percent values provided here differ from the table because table entries are rounded to the nearest whole percent.

While the raw distribution of the scale values on the belief statements is somewhat useful for detailed comparative purposes, it is perhaps more expedient to determine if there are patterned interrelationships within the data that can be used to construct multi-item scales. Within and between the two villages, these scales may provide a clearer picture of the distribution of beliefs concerning relationships between the coastal resources and human activities.

The scale values associated with the 10 attitude statements on relationships between coastal resources and human activities were factor-analyzed, using the principal component analysis technique and varimax rotation. The scree test was used to determine optimum number of factors to be rotated (Cattell 1966). The result of this analysis is shown in Table 23.

The majority of the statements loading highest (bold type) on each of the three components in Table 23 indicates patterns of interrelationships in the content of the statements. In turn, these patterns can be interpreted as dimensions of beliefs concerning relationships between the coastal resources and human activities. For example, the statements loading most highly on component one involve general beliefs concerning coastal ecosystem relationships involving the role of human activities. Statements loading high positive on the second component involve perceptions of the inexhaustibility and vastness of the ocean. Finally, statements loading highest on the third component involve the efficacy of human actions with

Table 23: Principal component analysis of beliefs about relationships between coastal resources and human activities

Statement	Component 1	2	3
6	**0.686**	0.314	0.160
4	**0.620**	0.004	-0.239
10	-0.047	**0.735**	0.020
9	0.132	**0.684**	-0.033
8	**0.409**	-0.599	0.295
5	0.399	**0.569**	0.145
3	-0.107	-0.067	**0.753**
2	0.052	0.158	**0.741**
1	0.428	-0.308	**0.599**
7	**0.474**	-0.036	0.072
% Total Variance	16.240	19.153	16.709

respect to health of the resource. We will refer to these, respectively, as the "Ecosystem," "Vastness" and "Efficacy" components.

Factor scores were created representing the position of each individual on each component. The factor (or component) scores are the sum of the component coefficients times the sample standardized variables. These coefficients are proportional to the component loadings. Hence, statements with high positive loadings contribute more strongly to a positive factor score than low or negative loadings. Nevertheless, all statements contribute (or subtract) from the score; hence, statements with moderately high loadings on more than one component (e.g., statements 5 and 1 in the analysis presented here) will contribute at a moderate level, although differently, to the factor scores associated with each of the components. This type of factor score provides the best representation of the data. We will refer to these types of factor scores as "Resource Beliefs" component scores. They are standardized scores with a mean of zero and a standard deviation of one. Mean scores for each component were calculated for Bentenan and Tumbak. An analysis of the differences in the mean scores indicates that the differences are not statistically different, a result similar to the findings with respect to the individual items (see Table 24).

Table 24: Resource beliefs component scores in villages

Component	Benetton Mean	SD	Tumbak Mean	SD	t	p
Efficacy	-.015	1.12	.017	0.86	0.18	0.86
Ecosystem	-.151	1.05	.178	0.91	1.83	0.07
Vastness	.108	1.02	-.127	0.97	1.29	0.19
N	66		56			

df = 120

Example 20: Perceptions of resource impact from human activities—analysis of categorical data

As a means of determining respondents' perceptions of the impact of bomb-fishing and why fishers practice the technique, respondents were asked two questions: First, does bomb-fishing hurt the resource, and second, why do fishers bomb fish? Turning first to impacts, a large majority of respondents agree with the statement that bomb-fishing hurts the resource (88 percent in Bentenan, 96 percent in Tumbak, and 94 percent in each of the control villages). Only one respondent said it did not hurt the resource; the others responded that they did not know. The largest percentage that responded that they did not know are from Bentenan (12 percent).

As to why fishers use the technique, the most frequent response category is that it is a quick and/or easy way to obtain lots of fish and/or money (39 percent of respondents used this response). The second most frequent response category is that it is the fisher's way of making a living (12 percent). Other moderately high categories were that the government is not enforcing the law (7 percent), they know how to do it (5 percent), and habit (4.4 percent). Interesting low frequency categories include that it is fun and they like to hear the bomb (less than one percent each). Another interesting response category related to bravery and the lack of fear of being caught (one percent). Finally, about two percent of the respondents related the use of bombs to lack of thought for the future.

Table 25: Percent distribution of the perception that bomb-fishers fish that way because it is a quick/easy way to obtain fish/money

	No	Yes	Total	N
Bentenan	60.61	39.39	100.00	66
Tumbak	64.29	35.71	100.00	56
Rumbia	55.77	44.23	100.00	52
Minanga	62.00	38.00	100.00	50
Total	60.71	39.29	100.00	
N	136	88		224

Table 26: Percent distribution of the perception that bomb-fishers fish that way because it is their way of making a living

	No	Yes	Total	N
Bentenan	95.45	4.55	100.00	66
Tumbak	94.64	5.36	100.00	56
Rumbia	86.54	13.46	100.00	52
Minanga	72.00	28.00	100.00	50
Total	87.95	12.05	100.00	
N	197	27		224

Distribution of the two high frequency response categories across the four villages can be found in Tables 25 and 26. There is no statistically significant difference between the four villages with respect to perceptions that bomb-fishers use the technique because it is a quick/easy way to obtain fish/money (Chi-square = 0.87, df = 3, $p > 0.05$). The differences in percent distribution across the villages in Table 26, however is statistically significant (Chi-square = 17.97, df = 3, C = 0.27, $p < 0.001$). The control villages manifest higher percentages of this response, with Minanga having the highest.

Perceived Quality of Life and Problems

While the general description of the community and the material style of life analyses provide some indication of quality of life in the community, it is also important to ask residents how they feel about their well-being and the problems that they face. This must be done using survey methods. Interviews of only key informants or groups of key informants will never provide the wide range of concerns voiced by a sample of individuals in a one-on-one interview. Key informants or groups of key informants may think they can speak for all community members, but usually speak only for their own interests or the interests of their narrow group of friends.

Numerous techniques have been developed to assess perceived well-being and problems. Well-being is usually assessed in a relative sense, comparing perceived well-being today with some period in the past. Techniques used can range from self-anchoring scales (Cantril 1963) where the respondent is shown a 10 or 15 step ladder and told that one end of the ladder represents the best possible conditions (best house, best furnishings, everyone healthy) and the other end the worst (homeless, sick). The respondent is asked where on the ladder he/she is today (the self-anchoring aspect) and where she/he was five years in the past. Today's position on the ladder represents the individual's perception of his/her position in terms of his/her perception of the best and worst conditions. The number of ladder steps (up or down) indicate the amount of change the individual perceives over the past few years. Asking why the perceived change has occurred adds richness to the data that can also be analyzed.

A less complex method is to simply ask if the individual is better off, worse off, or the same as five years ago. Once again, asking why provides richness to the data. Both of these methods can be used to determine the individual's perceptions of the future by asking the same question about five years hence.

General information concerning the respondent's perceptions of problems can be obtained by simply asking what types of problems they and their family are facing in the community today. This is an open-ended question that can yield a great deal of rich detail.

Analysis of this type of question, as well as the reasons why for changes in perceived well-being, is not simple, but can be done as illustrated in the examples below adapted from Pollnac et al. 1997b and 1998.

Example 21: Perceived quality of life and problems

To determine how individuals in the two villages evaluate their present quality of life, they were asked to compare their household well-being today with that of five years ago (better off, worse off, or the same) and to provide the reasons for the perceived change or lack of it. Overall, 11 percent of Bentenan residents classify their household well-being as worse off in contrast to 20 percent of those from Tumbak. The difference, however, is not statistically significant (Chi-square = 0.79, $p > 0.05$). However, 11 percent of Bentenan residents, in contrast to 30 percent of those in Tumbak note that there has been no change in the last five years, and this difference is statistically significant (Chi-square = 7.47, Phi = 0.25, $p < 0.01$). Finally, over three-fourths (77 percent) of Bentenan residents feel that their household well-being has improved over the past five years, in contrast to almost one-half (48 percent) of those from Tumbak, a statistically and practically significant difference (Chi-square = 8.71, Phi = 0.27, $p < 0.005$). Four percent of the respondents (2 percent from each village) said they did not know. Overall, it appears that more Bentenan than Tumbak residents feel positive about changes in their household well-being.

The almost 70 reasons provided for these changes are coded into the 20 response categories found in Tables 27 and 28. Only the first, hence most salient, responses are analyzed in this section, and only response categories representing responses provided by more than 5 percent of the total sample are statistically analyzed. What is significant is the wide range and diversity of responses provided. This result, in itself, argues for the sample survey approach used here. One is able to see how easy it would be to obtain biased interpretations of relevant issues in a community if only a few key informants were interviewed. One is able to see how easy it would be to obtain biased interpretations of relevant issues in a community if only a few key informants were interviewed.

Comparing the first, most salient, responses which are provided by more than 5 percent of the total sample, we find that Bentenan residents are more likely to cite infrastructure improvements (e.g., roads, electricity, running water) as contributing to improved household well-being than Tumbak residents (35 versus 13 percent, respectively; Chi-square = 8.16, Phi = 0.26, $p < 0.005$). Further, Tumbak residents are more likely than Bentenan residents to blame lack of progress on having the same gear and the same income (18 versus 5 percent respectively; Chi-square = 5.64, Phi = 0.22, $p < 0.025$). While Tumbak residents

are more likely to cite new job opportunities and changes in income (both positive and negative) as contributing to changes in household welfare, none of the differences are statistically significant. Finally Bentenan residents are more likely not to have a reason for perceived changes than Tumbak residents, but the difference is not statistically significant (Chi-square = 0.31, $p > 0.05$). The first, and most salient, responses which are provided by more than 5 percent of the total sample were also cross-tabulated with sex, age and education, dichotomized at the sample means (41.7 and 5.7 years respectively). With respect to the responses that can be attributed to these three variables, there are no statistically significant differences.

Table 27: Reasons for perceived changes cross-tabulated with village (reason # 1)

Frequencies			
Benetenan	**Tumbak**	**Total**	**Reasons**
23	7	30	Improved infrastructure
11	2	13	Other
3	10	13	Same income/same gear
3	0	3	Improved marketing
3	5	8	New job opportunities
4	4	8	Increased income
5	2	7	Don't know
1	6	7	Decreased income
3	1	4	Improved household material culture
3	1	4	Decrease (not specific)
1	3	4	Poor health
2	1	3	Improved fish harvest
1	2	3	Inflation
1	2	3	Deficient equipment
0	3	3	Price paid fisher for fish increases
0	3	3	Lower harvest
0	2	2	Improved fishing gear
0	2	2	Lack of government assistance
1	0	1	Can pay school fee
1	0	1	BBR buys too much land
66	56	122	

Table 28: Reasons for perceived changes cross-tabulated with village (reason # 2)

Frequencies			
Benetenan	**Tumbak**	**Total**	**Reasons**
51	43	94	No second response
13	5	18	Improved infrastructure
1	2	3	Price paid fisher for fish increases
0	2	2	Improved marketing
0	1	1	New job opportunities
0	1	1	Improved household material culture
0	1	1	Can pay school fee
0	1	1	Deficient equipment
1	0	1	Lower harvest
66	56	122	

Turning to perceived problems, almost 60 distinct problems were provided by the respondents. These responses are coded into the 21 response categories found in Tables 29 and 30.

Table 29: Reasons for problems cross-tabulated with village (reason # 1)

Frequencies			
Benetenan	**Tumbak**	**Total**	**Reasons**
37	12	49	Lack of sufficient money
1	18	19	Lack of drinking water
8	2	10	Inadequate financing for dependents
3	6	9	Lack of or deficient gear
2	6	8	Low or variable fish harvest
2	3	5	Poor health
0	4	4	Restricted access to mangroves
4	0	4	None
3	0	3	Lack of infrastructure
2	0	2	Lack of modern material items
0	2	2	Insufficient food
1	1	2	Don't know
1	0	1	Bad weather
1	0	1	Use of destructive fishing methods
0	1	1	Competition from outside fish buyers
0	1	1	Prohibited to harvest turtles
1	0	1	The future
66	56	122	

Table 30: Reasons for problems cross-tabulated with village (reason # 2)

Frequencies			
Benetenan	**Tumbak**	**Total**	**Reasons**
59	32	91	No second response
0	8	8	Bad road
1	4	5	Lack of sufficient money
0	4	4	Lack of drinking water
1	3	4	Lack of or deficient gear
3	0	3	Inadequate financing for dependents
0	1	1	Low or variable fish harvest
0	1	1	Bad weather
0	1	1	Poor health
1	0	1	Insufficient food
0	1	1	Competition from outside fish buyers
0	1	1	Difficult to find employment
1	0	1	Difficult to find something to sell
66	56	122	

According to the distributions of the first, most salient problems mentioned by more than 5 percent of the total sample, Bentenan residents are more likely than Tumbak residents to mention money (56 versus 21 percent respectively; Chi-square =15.1, Phi = 0.35, $p < 0.005$) and financing dependents (12 versus 4 percent respectively; Chi-square = 2.94, $p > 0.05$). Tumbak residents are more likely to mention lack of or deficient gear (11 versus 5 percent respectively; Chi-square = 1.68, $p > 0.05$), lack of drinking water (32 versus 2 percent respectively; Chi-square = 21.6, Phi = 0.42, $p < 0.005$), and low or variable harvest of fish (11 versus 3 percent respectively; Chi-square = 1.79, $p > 0.05$). As can be seen by the Chi-square analyses, only two of these differences are statistically significant: citing of money as a problem by residents of Bentenan and the lack of water for Tumbak residents. The first, most significant responses from more than 5 percent of the total sample were also cross-tabulated with sex, age and education, dichotomized at the sample means (41.7 and 5.7 years respectively). The analysis indicated that there are no statistically significant differences with respect to the responses that can be attributed to these three variables.

In sum, the diversity and range of responses to the open-ended questions concerning changes in quality of life and perceived problems suggest that there is a great deal of variability on these issues among the residents of Tumbak and Bentenan. For the most part, residents of both villages perceive an improvement over the past five years, but only about half (48 percent) of Tumbak's residents perceive improvement, in contrast to over three quarters (77 percent) of Bentenan's. Almost one third of Tumbak residents perceive no change. Bentenan residents are

more likely to attribute these positive changes to improvements in infrastructure (roads, electricity, and availability of potable water), while Tumbak residents are more likely to attribute lack of progress to having the same gear and income. In terms of perceived problems, Tumbak residents are more likely to cite lack of potable water, while Bentenan residents complain about lack of adequate capital to finance improvements. The lack of potable water in Tumbak is a pressing problem that probably accounts, at least in part, for the differences between the two villages in terms of the recognition of the role of infrastructure in perceived progress. The complaint of inadequate capital is one frequently voiced by residents of developing areas, even after improvements of infrastructure, as in Bentenan.

3.4 PROBLEM IDENTIFICATION

One of the goals (some say the primary goal) of a baseline is to provide information of use for analyzing impacts of project interventions (Pollnac 1989). Another goal, however, is to provide information essential to the identification of problems and the proper formulation of intervention strategies. While initial project strategies are often formulated on the basis of rapid assessment or preconceived notions of the needs of target areas, it is essential that early phases of implementation be adaptive to the realities of the local situationærealities that often cannot be evaluated until the project has started. An in-depth baseline assessment should be one of the first activities conducted by a project, as it will also provide a preliminary assessment of key coastal management problems at the project site. A summary of the problems identified should be placed in the beginning of the baseline report, typically as part of an executive summary. An example is provided below from the baseline conducted at Bentenan and Tumbak, North Sulawesi, Indonesia (Pollnac et al. 1997b).

Example 22: Problem identification

The baseline identified a total of 15 problems that a coastal resources management strategy might address:

1. Lack of territoriality in the capture fishery
2. Lack of perceived crisis with respect to marine resources
3. Misconceptions of relationships between human activities and coastal resources
4. Impacts of tourism
5. Fishing activities damaging to coral reefs
6. Non-fishing activities that harm coral

7. Reduction of fish populations with use of small mesh nets
8. Capture of gravid or spawning fish
9. Coastal erosion and inappropriate coastal construction
10. Upland activities influencing runoff and pollution
11. Capture of endangered and rare species
12. Forest degradation caused by gear construction methods and other coastal activities
13. Sanitation and solid waste disposal
14. Inadequate potable water supply
15. Intracommunity diversity and coastal resources management

Some of these same issues are described in Example 4: Preliminary appraisal summary for a region (see pp. 30–37), so they will not be repeated here. Of the remaining issues, several are included in this example. For those interested, all 15 are discussed in the executive summary of Pollnac et al. (1997b).

Lack of territoriality in the capture fishery The Indonesian Constitution, Article 33:3 notes that all sea waters are state property. Similar national laws exist in other countries, but local fisher communities frequently claim nearshore, and sometimes offshore waters as communal property and require that others obtain permission before fishing, and in some cases, vigorously defend their communal waters (Acheson 1988). Such behavior is found in the United States (Acheson 1988), the Philippines (Pollnac and Gorospe 1998), and many other places around the world (Dyer and McGoodwin 1994). In contrast to the communal rights claimed by fishers in many other fisheries, the capture fishery of Tumbak and Bentenan appears to manifest no evidence of communal property or territoriality. Numerous researchers have related territoriality to success in management efforts (Pinkerton 1994, 1989, Pollnac 1994, White et al. 1994a). Caroline Pomeroy supports these findings, writing that "boundaries enhance fishers' sense of control over the shared resource and the likelihood that they will work to sustain its use over the long term" (1994:37). Local fishers questioned about *pajeko* or *giop* from other communities, observed fishing in waters just off Bentenan and Tumbak, say that anyone can fish their waters, and that they, themselves, also fish the waters of other communities along the coast. Even non-local diving fishers, using lights at night and diving from unmotorized *londe* to fish the reef flats a mere 10 to 20 m offshore elicit no negative comments from local residents. Spear fishers from Tumbak report that they often fish the waters off other communities. Finally, the fish aggregating devices deployed by Bentenan fishers are meant to be fished by fishers from other villages.

It can be argued that this relatively open access is adaptive for the fishers of the Maluku coast of Minahasa. First, *pajeko* and *giop* fishers concentrate on pelagics and

reef associated pelagics, which concentrate on different parts of the coastline during various times of the year. At the present time, freedom to move from place to place maximizes the catch for all fishers. Second, this freedom of movement also provides an opportunity for local lightboats to attract from a larger pool of *pajeko* than locally available, increasing their opportunity to obtain a one-third share of a *pajeko* harvest. Third, and related to the second factor, there are aggregations of fish in the waters of Bentenan and Tumbak of which local fishers cannot take advantage, due to limitations in their fleet (e.g., number of mini-purse seiners). Some of the local fishers, however, can afford to construct and deploy fish aggregating devices (FADs) which aggregate certain species and attract non-local *pajeko* fishers who then share one-third of their harvest with the local FAD owner as discussed below. This, in effect, allows local fishers to obtain a significant share of the catch of fish from their waters, which they are, at present, technologically unable to harvest efficiently themselves.

This adaptation is facilitated by several factors. Residents of many coastal areas of the Maluku seacoast of Minahasa are ethnically and culturally distinct from nearby inland residents. They are frequently Islamic in contrast to the Christian farmers located sometimes a kilometer or less from the coast. The coastal fishers are also usually immigrants or descendants of recent immigrants from other areas. Ties are maintained between these coastal dwellers, and they frequently have friends or kinsmen in villages all along the coastline. For example, when target fish are more readily captured off Bentenan, after a night's fishing, *pajeko* fishers from Kema anchor their boats just off the village beach, pray in the village mosque, and some sleep in kinsmen's houses. They can sell their catch through the Bentenan TPI or have it picked up by the vessel owner's representative and trucked to market. After resting in the village all day, they can then set out fishing again at night, saving both travel time and expense. It appears that the coastal fishers tend to think of themselves as part of a larger coastal communityæone where they have closer relations with fishers from other villages than with the inland farmers living in their home village.

Hence, the sea is conceptualized as communal property for the entire coastal community of fishers, which retains contact through both fishing and non-fishing activities. Despite the fact that this adaptation appears to be related to effective exploitation of the resource at the present time, it does not bode well for the establishment of CB-CRM since, as noted above, numerous researchers have related territoriality to success in management efforts (for example, Pinkerton 1994, 1989, Pollnac 1994, Pomeroy 1994b, White et al. 1994a).

Lack of perceived crisis with respect to marine resources Residents of Bentenan and Tumbak do not feel that the availability of marine resources is threatened at the present time, although some fishers note that they must travel a bit

farther to obtain good catches and a few species have decreased significantly (e.g., sea cucumber, Mantjoro 1997). The lack of concern with these slightly decreasing catches and isolated instances of significant decreases is evident in responses to attitude questions as well as perceived problems and perceived factors influencing changes in household well-being. Pinkerton (1989) notes that a perceived crisis in resource depletion is a factor that contributes to the success of community-based coastal resources management. Lack of such a perception among residents of Bentenan and Tumbak may make them more reluctant to participate in a community-based coastal resources management project. Public education campaigns can address this issue.

Misconceptions of relationships between human activities and coastal resources Analysis of responses to belief statements indicate that there are widespread misconceptions concerning relationships between the coastal resources and human activities. The larger number of inaccurate perceptions is related to relationships between the health of coastal resources and farming the hills, disposal of garbage on the beach, God's ability to take care of the resource no matter what humans do, and the possibility of over-harvesting the fish in the sea.

The results of the analysis, however, clearly indicate that there is wide variation in the communities with respect to these beliefs. Some do hold beliefs that are favorable to coastal resources management, while others do not. Also, some behaviors suggest that there is some knowledge that can be built on for CB-CRM purposes. For example, residents of Tumbak do not cut the mangroves immediately to the northwest of the village, nor do they mine the coral immediately offshore. The community has also replanted a few small areas of mangrove behind the village. Their rationale for this behavior is that the coral and mangrove protect them from erosion that would surely result from the wave action generated by monsoon winds at various times of the year. They do, however, mine and bomb corals further offshore, as well as cut mangroves in other areas. Significantly however, over 90 percent of the sample from both villages believe that bomb-fishing harms the marine environment, a perception that should be encouraged and used to eliminate this destructive behavior. These issues can also be addressed by public education programs.

Capture of gravid and/or spawning fish Fishers report that the fish aggregating devices, deployed in August, target, for the most part, *ekor kuning* (yellow tail scad, *Atule mate*). They also report that the fish are gravid and spawning at this time. This may have an important impact on future numbers of this species; hence, reports concerning the status of yellow tail scad at the fish aggregating devices in August and September should be investigated.

Capture of endangered and rare species Tethered and caged hawksbill turtles were observed in both Bentenan and Tumbak. While some fishers are aware

of laws governing their capture, some are not, as evidenced by the fact that they proudly displayed their captive turtles. They were not questioned about their knowledge of the law lest it inhibit their responses on other questions, creating difficulties in terms of obtaining information essential to the assessment. Fishers aware of the law say that they sometimes hunt turtle, if someone makes a request, because it can represent a substantial increment to their income. Dugong are also occasionally captured and eaten. A dugong skin hung to dry was observed in Tumbak. Finally, crocodiles (salt or brackish water) have been hunted to local extinction in the mangroves of Tumbak and the Sompini River (Mantjoro 1997).

Inadequate potable water supply As is common in many parts of the world, there is a shortage of potable water. Tumbak, surrounded by mangrove swamps and the sea, has the greater problem. A potable water supply system built for Tumbak a few years ago no longer functions. Tumbak residents allege that their supply was cut by residents of the neighboring village of Tatengesan to divert additional water for rice cultivation. As a result, potable water supplies for Tumbak are collected in plastic containers in the nearby Sompini river and transported to the village by boat. In Bentenan, water distribution systems pipe water from nearby springs to every *dusun*. Nevertheless, shortages, particularly during mid-day periods, are frequent in the two coastal *dusuns*. Also, frequent outbreaks of gastrointestinal illnesses have been reported by villagers from both Tumbak and Bentenan, and contaminated water supplies are suspected as a main cause. Recently sampled by a water development board team, the piped water supply in Bentenan, tested positive for coliform bacteria.

Intracommunity diversity and coastal resources management It is extremely significant that survey questions resulted in a wide range and diversity of responses. In itself, this result argues for the sample survey approach used here. One should be able to see how easy it would be to obtain biased interpretations of relevant issues in a community if only a few key informants were interviewed. Diversity must be addressed in any attempt to develop community-based coastal resources management efforts. Overgeneralization, to simplify the process, can easily lead to project failure, as a result of disregarding the needs, attitudes, beliefs, and values of a diverse population.

3.5 CONCLUSIONS

The baseline described above consists of a description of the human behavioral characteristics of a community at a single point in time. It can be used as a starting point in the design of CB-CRM strategies, but discussion of this process is outside the scope of this manual. This manual is concerned with the baseline as a point of comparison, a compilation of data at one point in time that can be used to determine changes over time. The key to being able to do this effectively is the use of the same instruments, looking at the same variables at different time periods. Any change in questions asked, or variables assessed, will invalidate measurement of change. Once the methods have been applied, one is stuck with them, even if more accurate or sophisticated techniques are developed or discovered later.[6] The solution to this dilemma is to avoid it by using the best methods, given available resources, with the understanding that any changes will damage the ability to compare the project sites, either with each other, or at different times. The use of a baseline for monitoring and evaluation is explained in the following chapter.

[6] In the unlikely event that some major catastrophe destroys many houses in the community, resulting in new construction that would invalidate the old material style of life scale (MSL), one would not be able to make the type of MSL comparisons discussed in this chapter. If not all houses were destroyed, one could adjust sampling procedures and make comparisons within the old house group. One might be able to imagine other scenarios that would result in problems applying the same measures at time one and time two. Such scenarios are highly unlikely, but could be handled using common sense methods similar to the one discussed in this footnote or the baseline free methods discussed in Pollnac and Pomeroy (1996).

4

MONITORING AND EVALUATION

4.1 INTRODUCTION

This section describes techniques for monitoring and evaluating CB-CRM project impacts.[7] The ultimate goal of a CB-CRM project is to improve, in a sustainable manner, the well-being of the coastal ecosystem, including both the natural and human communities. To achieve this goal, one usually identifies a naturally or artificially bounded coastal ecosystem or political unit (for example, a segment of coastline, a community's coastal resources, a bay, a district) and develops a set of strategies and intermediate objectives directed at improving its well-being. This is followed by implementation of activities directed at gaining the intermediate and ultimate objectives. The extent to which these two types of objectives are achieved are the project impacts. Hence, there are two distinct types of impacts. The first is achieving implementation of a project strategy, such as establishment of a marine protected area (MPA), implementation of local CRM ordinances, reforestation of mangroves, or returning milkfish fry bycatch to the sea. This is referred to here as an intermediate impact—intermediate because it is only a strategy used to achieve the ultimate objective of improvement of the coastal ecosystem. The second is the degree of achievement of this ultimate objective—improvement of the well-being of the coastal ecosystem, in both its human and non-human elements. This includes, for instance, improvement in coral reef quality, an increase in residents' quality of life and/or increased fish production. Impacts of this nature are referred to here as "ultimate impacts."

The system of project monitoring and evaluation in this section tracks both types of impact, during and after project implementation. The baselines (described in the previous chapter) provide the standard for comparison, as they provide information on the pre-project status of the coastal ecosystems in both project and control communities. Baseline information is compared to that collected during project implementation (monitoring), at project completion (evaluation) and several years following completion (post-evaluation). At all these stages, proper use of data from controls, along with sensitivity to other factors potentially influencing project objectives, will permit evaluation of both intermediate and ultimate project impacts.

---

[7] Some (see EPA 1994) refer to "impacts" as project "outcomes," some use simply "impacts" (cf. White 1986), and some use the terms interchangeably (see Margoluis and Salafsky 1998). While the two concepts are similar, the connotation of "impact" is stronger and more forceful, hence, preferred by the authors of this manual when discussing the outcomes of resource management efforts.

The logic of the monitoring and evaluation system proposed here is as follows. A project management team develops a set of intermediate objectives to improve the ecosystem's well-being. This is followed by implementation of activities to achieve intermediate and ultimate objectives. Each step in this process involves decisions and actions that can influence the achievement of objectives. A number of variables have been identified as associated with achievement of project objectives (cf. Pomeroy 1994a,b; Pomeroy et al. 1996, 1997, White, et al. 1994a,b; Dyer and McGoodwin 1994; Pollnac 1994; Pinkerton 1994; Pinkerton 1989; McGoodwin 1990; Ostrom 1990; World Bank 1999). They include:

- Social, political, institutional and economic aspects of the larger context of the project ecosystem
- Sociocultural, techno-economic, and biophysical attributes of the project ecosystem
- CB-CRM implementation processes

To learn from the process of monitoring and evaluation, one must account for this wide range of variables that may influence levels of achievement in reaching objectives.

Conceptually, variables allegedly influencing the level of achievement of CB-CRM objectives are classified as independent variables. These independent variables are further subclassified as project variables and context variables. Project variables include aspects of CB-CRM planning and implementation. Context variables are non-project, independent variables, such as:

- Social, political and economic aspects of the larger context of the project ecosystem, such as national legislation affecting resource management, or markets for project ecosystem products
- Techno-economic, biophysical, and socio-cultural aspects of the project ecosystem, including technology used in harvesting the resource, value of resource for income and household nutrition, perceptions of resource abundance, and natural boundaries of resource

The dependent variables, levels of achievement of CB-CRM objectives, constitute the second general category of variables. This category is also composed of two distinct subsets: first, achievement of intermediate objectives; and second, impacts on the well-being of the coastal ecosystem. The first subset will include consideration of the degree of achievement of both material (for example, mangrove planting, construction of meeting and information centers) and non-material (training, institution building, etc.) objectives. The second subset, the ultimate evaluation of project impact, includes consideration of project influences on the well-being of the coastal ecosystem, and is composed of separate measures of its human and natural components. Each of these components is composed of its own distinct sets of variables, such as changes in income, access to resources, and/or availability of resources. Although categorized as dependent variables for one level of analysis, the achievement of intermediate objectives can be characterized as antecedent to achievement

of the ultimate objective of ecosystem well-being, making it also a part of the set of independent variables for the final level of analysis.

4.2 PROJECT MONITORING AND EVALUATION

Monitoring is perhaps one of the most important aspects of project implementation. Through monitoring, project managers learn if interventions are working or not, and whether it is the project activities themselves or some contextual variable that is at fault. This is called adaptive management (Margoluis and Salafsky 1998), and is a key strategy to be used to learn from mistakes, not doomed to repeat them, as so often characterizes CB-CRM projects.

Ideally, monitoring begins upon implementation, as soon as project activities directed at achievements of intermediate and ultimate objectives begin. It is not realistic to expect measurable changes with respect to ultimate objectives in the first few years of a project. One can, however, carry out assessments of project activities and changes in contextual variables, possibly identifying issues missed in baseline assessments, and conduct evaluations of achievement of intermediate objectives. A common strategy employed by CB-CRM projects as part of both implementation activities and monitoring is to assign extension workers to live in the target communities. They help identify issues that may have been missed in initial baselines, and also gain understanding of the social and political context influencing these issues. The extension workers obtain this information by using techniques such as community immersion and participant observation; long-term direct observations; informal individual, key informant and small group discussions; formal focus groups or community meetings; and community mapping, as well as other participatory and non-participatory appraisal methods.[8] An example of the use of extension agents and the monitoring information they can produce is provided below.

Example 23: Village extension reporting system and identification of contextual variables that can impact a project strategy

Once baseline surveys were completed in North Sulawesi, *Proyek Pesisir* assigned full-time extension agents to selected field sites. Field extension agents live and work in the villages for three weeks every month, returning to the main office during the last week of every month for work reporting, monitoring, review and subsequent monthly work planning. During the week in the main office, extension officers provide verbal and written reports on village project activities, as well as other issues that may affect project implementation. Reports are discussed with senior extension staff and with their peer (field extension) workers from other

[8] Detailed discussions of these methods can be found in IIRR (1998).

field sites. Project activities are also monitored by senior extension staff, technical consultants and advisors, during periodic visits to field sites. Extension staff monthly reports include the following types of information:

- Number of formal meetings, training and public education events held, and for each event, an agenda, attendance list, gender distribution of attendees, minutes of meetings and decisions made
- Summary of other activities conducted (informal meetings and discussions, participatory beach profiling, reef mapping or village transects conducted, early implementation actions planned or conducted, etc.)
- Issues identified or problems encountered, and recommendations

The field level monitoring information from extension officers' reports and field visits by senior extension staff promotes a better understanding of the management issues identified and helps determine what actions the project takes to solve coastal resource management problems. Two examples are provided where monitoring activities discovered changes in environmental conditions, or uncovered socio-political issues that impacted project strategies.

1. Initial environmental surveys showed high numbers of Crown-of-Thorns (COTs) starfish on several sections of the coral reefs adjacent to Bentenan and Tumbak. Six months later the field extension officer and technical advisor conducted a follow-up snorkeling survey that detected a significant increase in the COTs population on the reef. COTs eat live coral, and rapid increases in their population can lead to a swift decline in live coral cover. A COTs specialist from Australia was consulted, who determined that a COTs outbreak was occurring. The project informed the community of the implications and recommended that a clean-up be organized. The community agreed, and two clean-up events were organized with participation of the community, local dive operators, and NGOs. Over 1,100 COTs were removed from the most severely affected parts of the reef, restoring the COTs population to normal levels and preventing significant reef degradation.
2. One of the reasons the village of Talise was selected as a project site was its apparent level of community harmony, compared to other candidate villages in the area. Traditions of cooperation and collective action (Jentoft 1989), as well as cultural homogeneity (Jentoft 1989, Doulman 1993, Pinkerton 1989, White et al. 1994a) have been found to be important community-level contextual variables, predicting success of community-based management. Several months after project implementation began, the field extension worker assigned to the village reported that previously unrecognized rivalries between several church factions in one of the sub-village

> settlements were impeding project activities. It was difficult to organize project meetings and activities or obtain consensus among the residents on coastal resources management issues or early implementation actions. Project management decided to continue organizational efforts in the fractious sub-village, but to shift principal efforts to organizing the other sub-villages to start early implementation actions, including monitoring of beach profiles in erosion-prone areas and construction of a sub-village meeting and information center.

The above example provides a good illustration of the utility of monitoring contextual variables that might impact project success. In the first example, the baseline suggested a need for periodic monitoring of Crown-of-Thorns abundance. The monitoring indicated the need for the clean-up activity, and a decision was made to continue periodic monitoring of Crown-of-Thorns. The second example demonstrates how monitoring of project implementation activities can identify contextual factors with negative impacts. Once it was determined that organizational efforts were being thwarted by a notoriously intractable issue (religious factionalism), principle efforts were shifted to other sub-villages—a good example of adaptive project management. Without careful, sensitive monitoring activities, either of these issues could have had negative impacts on the ultimate objectives.

Another type of essential monitoring concerns achievement of sub-objectives. These usually constitute the strategies implemented to achieve the ultimate project goal. Typical strategies for improving the health of the coastal ecosystem often include, for example, improved disposal of sewage and other solid waste, cessation of destructive fishing methods, mangrove reforestation and establishment of MPAs. The first step in monitoring is to determine if a selected sub-objective is justified. The sub-objectives themselves frequently involve strategies that can be conceptualized as a series of sub-sub-objectives. For example, for a CB-CRM project, community members must first become aware of a problem and its potential solutions. This often involves a public education program that may involve community meetings, strategically placed informative posters, etc. The public education program, thus becomes a sub-sub-objective that must be monitored and evaluated. Meetings with community members must be held to select from various solutions. Once they are selected, an implementation plan must be developed (selection of area for mangrove replanting, identification of appropriate species, proper planting methods, protection of plantings, etc.).

Frequently, most of the intermediate objectives essential to achievement of a sub-objective are sequential. One must be achieved before the next one can be attained, and before the extension team and community can move on to the next steps in the CB-CRM process. In other instances, achievement of certain objectives through implementation of a set of

actions will have impacts on, and help achieve, other objectives. All these activities must be monitored to identify potential problems as they develop and to adapt the strategy to achieve the objective.

The process of adapting strategies to fit the project site leads to another important consideration. It is often difficult to predetermine how long each step or objective will take. Sometimes, a period of trial and error, testing several approaches, is required before an appropriate strategy is selected. This slows down the process, but increases the likelihood that the outcome is sustainable. There is often a tendency among CRM projects to strive to meet externally driven deadlines to show achievements quickly, with the emphasis being on reaching an activity output. Thus, the laborious process of monitoring and adapting strategies to ensure the sustainable achievement of intermediate objectives is often ignored. The consequence of such behavior is the failure to achieve subsequent intermediate or ultimate objectives.

Clearly, the monitoring and evaluation of sub-objectives is a complex process. It should start by justifying selection of the sub-objective and listing, in order of implementation, all intermediate objectives and the activities necessary to their achievement. All these activities should then be monitored and their impacts on intermediate objectives evaluated. Finally, after the sub-objective is implemented, it should be monitored in terms of its effectiveness in achieving the ultimate goals. The following example illustrates selected aspects of this process, as it was applied to the implementation of a marine sanctuary in Blongko, North Sulawesi.

Example 24: Monitoring and evaluating the implementation of an MPA

The strategy of using a community-based marine sanctuary in Blongko is justified by information from the environmental and socioeconomic baselines which indicates that the nearby coral reefs play a significant role in the livelihood of the community, and that they are in danger of being harmed by human activities. It is further justified by the fact that community-based marine sanctuaries in some localities in the Philippines have been shown to improve or maintain coral condition and fish abundance inside the sanctuary, and to increase fish production of reef-associated species adjacent to the sanctuary (White 1989, Russ and Alcala 1989). Finally, marine and coastal protected areas, in general, have been shown to have positive benefits on coastal ecosystems (Klee 1999).

Actions and expected outcomes to be monitored are outlined in the following table.

Table 31: Steps, actions, and outcomes expected from establishing a community-based marine sanctuary

Steps in the Planning and Management Process	Actions Taken	Expected Outcomes (Intermediate and Ultimate Objectives)
1. Community Socialization (i.e., activities that familiarize the project team with the community and vice-versa)	• Village site selected • Field worker assigned full-time to the village • Baseline surveys conducted • Ecological history and selected PRA activities conducted • Informational meetings (formal and informal) and discussions concerning the project conducted by the field worker	• CRM issues in the community identified • Socioeconomic, cultural and environmental context understood by project team • Widespread community and understanding of project objectives and approach
2. Public Education and Capacity Building	• Cross-visits with successful marine sanctuary sites • Public education on coral reef ecology, marine sanctuary concept, environmental law • Training on community monitoring and mapping of coral reef • Grants program for early actions started • Selected early actions implemented • Training on financial management and accounting • Study tour and training on marine tourism and potential supplemental livelihood opportunities • Community core group training on coastal management	• Community understanding of human impacts on marine resources, environmental laws and the sanctuary concept • Map of the coral reef developed by the community to be used as basis of marine sanctuary site selection • Community awareness of local coral reef conditions and capacity for ongoing monitoring established • Widespread community support for the project objectives and marine sanctuary concept • Community capacity to engage in participatory planning and implementation processes, and transparent funds management strengthened • Community capacity to address small localized coastal resources management problems with simple solutions strengthened
3. Community Consultation and Village Ordinance Formulation	• Village ordinance contents drafted • Community consultation meetings and discussions (formal and informal) conducted • Village ordinance contents revised and final version completed	• Widespread participation of stakeholders in marine sanctuary planning • Widespread/majority village consensus on marine sanctuary location, size, allowable and prohibited activities, sanctions, and management arrangements

Table 31: Steps, actions and outcomes expected from establishing a community-based marine sanctuary *(cont.)*

Steps in the Planning and Management Process	Actions Taken	Expected Outcomes (Intermediate and Ultimate Objectives)
4. Village Ordinance Approval	• Vote for approval of ordinance at an all-village meeting • Signatures on the ordinance by the head of the village and district • Formal opening ceremony conducted with provincial government representatives in attendance	• Formal acceptance of the marine sanctuary by the community and local government • Sound legal basis for management and enforcement
5. Implementation	• Boundary markers installed and maintained • Information signboards installed • Management plan developed • Management committee meeting • Reef and fisheries monitoring conducted • Enforcement actions occurring • Sanctions taken against violators • Public education ongoing	• High compliance with rules governing the marine sanctuary • Effective management of the marine sanctuary occurring • Improved coral cover inside the marine sanctuary • Increased fish abundance in the marine sanctuary • Increased catch of reef-related target fish species

Plans to monitor and evaluate each of the activities and expected outcomes were developed and applied. Given the large number activities and outputs associated with this strategy, only a few detailed examples are provided. The first example illustrates how the monitoring process is used to adapt activities to the village context.

Building consensus and participation As part of the process of establishing a marine sanctuary in Blongko village, the extension officer held formal *dusun*-level meetings to discuss the sanctuary concept, its expected benefits to the community (ultimate objectives) specific location of the marine sanctuary proposed, prohibitions and allowable activities within the sanctuary, and penalties for violators. The extension officer reported the number of persons and gender distribution attending these meetings in her monthly written reports.

A problem, however, was brought to light in monthly discussions with the field extension officers, as to who attended these meetings. The marine sanctuary was in an area used by, and crossed over by, reef flat gleaners, but this stakeholder group did not attend the meetings that were well attended by other members of the community.

In the meetings, it was proposed that no walking over the reef flat would be allowed. This would affect gleaners in two ways. First, they could no longer glean in the marine sanctuary area that included the reef flat, and secondly, this created a difficulty in reaching the reef flat on the far side of the sanctuary. The extension team concluded that this group had to be consulted and their concerns addressed. Either they had to agree to prohibit the activity, as proposed by other members of the community, or the prohibition had to be revised to address some of their concerns.

The extension officer personally invited gleaners to attend subsequent meetings. Some did; however, they never spoke at the formal meetings. At the same time, the extension team discovered, from visiting the sanctuary site and talking to community members, that there was a footpath behind the mangroves which could reach the reef flat on the far side of the sanctuary. This footpath could serve as an alternate route for gleaners, but it was inside the original boundaries of the sanctuary drawn on a map (it was proposed that no walking be allowed inside the sanctuary). This footpath was proposed as a reasonable route for the gleaners to get around the reef flat. Since gleaners would not attend or speak up in formal meetings, the extension worker met with gleaners informally at their homes to discuss the reef walking prohibition and use of the footpath. During the informal discussions gleaners expressed their support for the marine sanctuary and agreed to use the footpath behind the mangroves to reach the reef flat on the other side. The use of the footpath by gleaners was also discussed in formal meetings where the rest of the community agreed this should be allowed. It was agreed that the sanctuary boundary should not extend above the high tide line, hence, it would not include the footpath. Subsequently, the marine sanctuary village ordinance indicating location, allowable and prohibited activities, and penalties, was approved in an all-village meeting. The ordinance was then formally signed and approved by the head of village and other local officials.

This illustrates how, within one step of the planning process, project actions were occurring, but not initially achieving the intended intermediate objective. Monitoring indicated that a change in approach was required of the extension officer, ultimately leading to the desired result, that allowed the extension team to continue the next steps in the marine sanctuary planning process.

The next excerpt from the monitoring and evaluation plan for the Blongko community-based marine sanctuary illustrates the development of a process for monitoring and evaluating the impact of this specific strategy. It illustrates how additional monitoring information or baselines may be needed, once certain actions are taken or programs established. It includes information for monitoring and evaluating ultimate, as well as intermediate, objectives of the marine sanctuary. In many cases, the indicators chosen, or the site locations which need to be monitored, may differ from those obtained during initial baseline surveys.

Monitoring impacts of the sanctuary Once the Blongko marine sanctuary was formally established through a village ordinance, the extension team reconsidered what information would be needed to determine whether the sanctuary was successful. To determine success, the team felt it needed to know whether the sanctuary achieves its ultimate objectives concerning improvements in quality of life and environment. The extension team reviewed existing information and drew up new plans for monitoring the impact of the marine sanctuary. They concluded that the monitoring program would need to be simple, involve the community as much as possible, and should, at a minimum, include several key indictors in the following categories:

Biophysical Improved coral reef condition as evidenced by live coral cover should be measured by line intercept transects (LITs) and visual fish census conducted by technical extension officers, as well as community-conducted manta tow surveys. Original baseline data on reef conditions (LIT coral cover and visual fish census surveys) had been gathered only at stations outside the designated marine sanctuary in Blongko. While these stations serve as general indicators of reef condition as a whole in the area of Blongko, they can also serve as controls for comparing changes in coral reef conditions within and outside the sanctuary. However, since no data has been collected inside the sanctuary, new baseline surveys of coral reef condition need to be made in the sanctuary.

Socio-economic Increases in reef-related fish production should be measured by trends in catch statistics kept on key target species by spear fishers. This type of data did not form part of the general baseline, so methods for fisher record keeping will be introduced by project staff.

Governance Effective management of the sanctuary should be measured by narrative log entries, kept by the management committee in a bound notebook, with notes on violations occurring, enforcement actions, and meetings held by the management committee, etc.

Attitudes and Beliefs Surveys should gauge community perceptions concerning local control over the resources, well-being of the resource, and benefits received from the sanctuary.

Another example of monitoring to determine impacts of context variables involves both a climatic event and an economic crisis that occurred one year after baseline data were collected and project implementation begun. Due to the potential impact of these events on the well-being of the coastal ecosystem (human and non-human), it seemed desirable to monitor community members perceptions of changes in household well-being. This example also provides an excellent opportunity to demonstrate the usefulness of control group data. Additionally, since it is a time-one, time-two comparison, it can serve as a model for any time-one, time-two comparison, be it monitoring, evaluation or post-evaluation.

Example 25: Time-1, time-2 comparison demonstrating use of controls

Following the baseline conducted at Bentenan and Tumbak in June 1997 (Pollnac et al. 1997b), Indonesia was hit by both an extensive drought associated with El Niño and a severe economic crisis. At the peak of these crises, in July 1998, a mini-survey was conducted, which among other purposes, was directed at determining the impact these two calamities had on perceptions of household well-being in the two villages (Pollnac et al. 1998). As a means of determining changes due to the effects of the economic crisis, respondents were asked to compare their household well-being today (the peak of the crisis) with that one year prior to the crisis (better off, worse off, or the same). They were also asked whether they felt they would be better off, worse off or the same, five years in the future. The distribution of responses to the mini-survey (Bentenan-Tumbak, time-two—peak of the crises) is compared to the results of the baseline (Bentenan-Tumbak, time-one—pre-crises) in the tables below.

Table 32: Percent distribution of perceptions of changes in household well-being in Bentenan and Tumbak at time-1 and time-2

	Worse	Same	Better	Total	N
BT-T2	48.89	28.89	22.22	100.00	45
BT-T1	15.00	20.00	65.00	100.00	120
Total	24.24	22.42	53.33	100.00	
N	40	37	88		165

Note: Two *don't know* responses were eliminated from the analysis.
BT-T1 and BT-T2 = Bentenan/Tumbak time-1 and time-2 respectively.

Table 33: Percent distribution of perceptions of changes in future status in Bentenan and Tumbak at time-1 and time-2

	Worse	Same	Better	Don't Know	Total	N
BT-T2	11.11	17.78	62.22	8.89	100.00	45
BT-T1	.00	1.64	69.67	28.69	100.00	122
Total	2.99	5.99	67.66	23.35	100.00	
N	5	10	113	39		167

Note: BT-T1 and BT-T2 = Bentenan/Tumbak time-1 and time-2 respectively.

Tables 32 and 33 clearly show that there have been changes in perceptions of present and future household well-being at the project sites. The time-two data from

the project sites indicates an increase in the number of people who feel worse off and a decrease in the number who feel better off than in the past. The differences in Table 32 are statistically significant (Chi-square = 27.88, df = 2, C = 0.38, $p < 0.001$). Some of the cell frequencies in Table 33 are too low for a valid statistical test of the differences observed, but if we collapse the *worse off* and *same* categories we obtain Table 34. Table 34 clearly indicates that at time-two there is an increase in the *worse* and *same* categories and a decrease in the *don't know* responses. These differences are statistically significant (Chi-square= 32.97, df = 2, C = 0.41, $p < 0.001$).

Table 34: Percent distribution of perceptions of changes in future status in Bentenan and Tumbak at time-1 and time-2 with collapsed categories

	Worse & Same	Better	Don't Know	Total	N
BT-T2	28.89	62.22	8.89	100.00	45
BT-T1	1.64	69.67	28.69	100.00	122
Total	8.98	67.66	23.35	100.00	
N	15	113	39		167

Note: BT-T1 and BT-T2 = Bentenan/Tumbak time-1 and time-2 respectively.

The analyses thus far indicate that there has been an increase in the percent of project community members who feel that conditions have become worse, as well as a greater percent who feel that future conditions will be either the same or worse. What is surprising, given the drought and economic crisis, is the fact that more than one-half the community members feel that today's conditions are either the same as, or better than, in the past and most are still optimistic concerning the future. The next question is whether any of these changes in perceptions can be attributed to project activities? To do this, data from project communities must be compared with that from control communities.

The communities selected as controls were Rumbia and the coastal *dusun* of Minanga, communities just to the north and south of the project communities. Tables 35 and 36 compare July 1998 responses for the project and control sites on questions comparing household well-being today with that in the past as well as perceptions as to whether they feel they will be better off, worse off or the same, five years in the future.

Table 35: Percent distribution of perceptions of changes in household well-being over the past five years in project and control villages (July 1998)

	Worse	Same	Better	Total	N
Control	43.14	25.49	31.37	100.00	102
Project	48.89	28.89	22.22	100.00	45
Total	44.90	26.53	28.57	100.00	
N	66	39	42		147

Table 36: Percent distribution of perceptions of future status in project and control villages (July 1998)

	Worse	Same	Better	Don't Know	Total	N
Control	.98	6.86	17.65	74.51	100.00	102
Project	11.11	17.78	62.22	8.89	100.00	45
Total	4.08	10.20	31.29	54.42	100.00	
N	6	15	46	80		147

Interestingly, despite the drought and the economic crisis with its attendant inflation, more than half the respondents in both project and control communities feel that their situation is the same or better. This is doubtless due to the fact, as reported by many key informants, that prices paid for fish and agricultural products have kept up with, or exceeded, the costs. Differences between project and control sites (project = two communities; control = two communities) in Table 35 are not statistically significant. Table 36 has too many cells with low frequencies to perform reliable statistical tests on the entire table. The big difference in Table 36, however, is the percent difference in *don't know* responses. This difference, comparing *don't know* with all other responses, is statistically significant (Chi-square = 54.21, df = 1, Phi = 0.61, $p < 0.001$). The project communities are also more optimistic—they are more likely to say that they will be better-off in the future (*better* compared will all other responses, Chi-square = 28.86, df = 1, Phi = 0.44, $p < 0.001$).

The above analysis demonstrates that perceptions of changes in household well-being at project sites are not different from neighboring communities. This information coupled with the responses as to why (see Table 37 below), supports the hypothesis that perceived negative changes are due to the drought associated with El Niño and the economic crisis, and that project activities had no influence on these perceptions. In terms of perceptions of future status, project communities are more

optimistic (much more likely to respond *better*) and less uncertain (much less likely to respond *I don't know*) about the future.

To questions about reasons for changes in household well-being today, as compared to the past (provided by over 10 percent of respondents in either group) responses were:

- Drought
- Increasing income
- Inflation
- Decreases in the number of fish caught
- No change

Table 37: Percent distribution of reasons for change

Response	Project	Control	Chi Sq.	DF	Phi	Prob.
Drought	18	5	4.92*	1	0.21	<0.030
Increasing income	20	15	0.64	1	0.07	>0.050
Inflation	62	30	13.17	1	0.30	<0.001
Less fish caught	18	3	7.90	1	0.26	<0.010
No change	4	15	3.22	1	0.15	>0.050

N = 147; * = Yates corrected Chi-square

A comparison of the percent distribution of these responses is presented in Table 37. This analysis indicates that respondents from the project sites are more likely to attribute changes to drought, inflation, and less fish being caught, with statistically significant differences. It is possible that these differences reflect the fact that people in project sites are becoming more aware of the links between the environment and their economic well-being, due to the project's public education. They are also learning that they can take part in activities that can affect some of these trends. This is reflected in the finding that project sites are more optimistic concerning the future, as well as the fact that the control sites manifest more uncertainty, seen in the high percentage of *don't know* responses reported in Table 36. These response patterns suggest that project activities (public education, beach clean-up, Crown-of-Thorns removal program) are providing community members with a perception that they have some control over the condition of their resources, and their potential for a better future.

The above example illustrates several aspects of the use of baseline data in the monitoring and evaluation process. First, monitoring can narrow its focus to only those variables in the baseline which are assumed to be influenced by the contextual variable or variables that stimulated the need to monitor. In this case, it was hypothesized that the drought and economic crisis would impact villagers' perceptions of their present status compared to previous periods, as well as their perceptions of how well off they would be in the future. It was also assumed that due to the relative immediacy of the crises (they were at their peak when the monitoring exercise was conducted) there would not yet be any measurable impact on material style of life, as measured in the baseline. Hence, we only monitored perceived and projected changes in status, and supplemented this survey with key informant information concerning changes in costs of production and earnings.

The second aspect of this example that bears repeating is its illustration of the methods used in time-one, time-two comparisons. Project monitoring and evaluation is, for the most part, concerned with just this type of comparison. It comprises the central part of an evaluation, and the logic of this type of comparison is clearly described in the example. Statistical tests may vary depending on the level of measurement in the variables being compared, but the logic remains the same. Finally, the example provides an unambiguous demonstration of the function of control sites. Comparisons with the control sites indicate that perceived changes in status were the same for project and control villages, indicating that the impacts of the crises were not ameliorated by project activities. Differences in future status, however, were interpreted as indicating a project impact. Without controls it would have been impossible to discern these similarities and differences. Generalizing, without controls it is impossible to separate project impacts from the impacts of other changes in the larger context. The same logic applies in other types of evaluations, with different types of data, only the statistics used might change to reflect different types of data.

4.3 POST-EVALUATION

Post-evaluation (also known as ex-post-evaluation) occurs at the project end, preferably a year or more after its completion, if the project is relatively short (two years or less), and if project interventions (activities such as establishment of MPAs, and mangrove replanting) are completed close to the end. The delay is important because it is unrealistic to assume that such interventions would have a measurable impact on a coastal ecosystem's health in a lesser period of time. The delay also allows sufficient time to determine whether the changes in CB-CRM are sustainable.

The logic of post-evaluation is the same as that in monitoring and evaluation during project implementation, just more extensive. Several data sets are developed to conduct the post-evaluation. First, the same types of data included in the baseline for project and

control communities, covering both the human and natural environment, are collected once again. This information is used to make time-one, time-two comparisons of the human and non-human aspects of the ecosystem to assess the ultimate project objective—CB-CRM impacts on ecosystem health. This data set also includes non-project, contextual variables which may help evaluate observed changes. Second, all interim monitoring and evaluation reports are collected. Information in these reports, described in Section 4.1, can be used to identify both project and contextual variables that may account for observed changes. Third, the status of all sub-objectives must be assessed. Ideally, the monitoring reports will help form this data set. It is, however, essential to have current information on the status of interventions, such as MPAs, beach clean-up programs, etc., as some of these activities may have ceased or degraded since implementation. A fourth data set includes shocks (for example, changes in markets, a new road, typhoons, wars) to the system. Finally, the fifth data set includes villagers' perceptions of changes in the human and natural components of the coastal ecosystem that are supposed to be improved by CB-CRM. Although the other data sets allow us to assess these changes, it is the villagers' perceptions that influence their behavior related to activities that will insure project sustainability. The development and use of each of these data sets is discussed in separate subsections below.

Post-evaluation Data Set #1

Methods used for obtaining baseline data (Chapter 3) are the same as those used for the Post-Evaluation Data Set #1, and conditions in project and control villages at the two time periods are compared using the methods and logic illustrated in Example 22 (pp. 101–105). Methods for constructing some of the variables for comparison, however, need to be discussed.

For example, principal component analysis with component scores is used to develop material style of life (Example 12, pp. 56–59) and perception of human impacts on natural resource attitude scales (Example 19, p. 91–94). It is inappropriate to conduct another principal component analysis of the items that make up the scales using only the time-two (post-project) data, calculate component scores, and compare the time-one and time-two scores. This is due to the fact that interrelationships among the items may change between the two time periods, resulting in a somewhat different component structure. Component scores resulting from analyses of two data sets with different component structures are not comparable—they possibly reflect different item weightings, as well as differential distribution of items across the components. To properly conduct the time-one, time-two comparisons using these variables, it is necessary to combine the data sets, reanalyze the data using principal components, and calculate a new set of component scores for both time periods. Appropriate statistical techniques (e.g., analysis of variance, Student's T-test) can then be used to compare the two time periods using the methods and logic illustrated in Example 22.

Post-evaluation Data Set #2

This data set is composed of the monitoring and evaluation reports prepared for each of the intermediate objectives. Its principal function is to provide background information for the post-evaluation of intermediate objectives. If monitoring and evaluation reports are prepared as suggested in Section 4.2, information concerning both project and contextual variables may help account for the level of achievement of these intermediate objectives. For example, monitoring an MPA may have revealed that dynamite fishers from a neighboring village violated the sanctuary ordinance and destroyed most of the living coral. This could be used to account for findings in the post-evaluation on the impact of the sanctuary.

Post-evaluation Data Set #3

An inventory of all intermediate objectives and expected outcomes should be compiled using information contained in Post-Evaluation Data Set #2. Methods for evaluating impacts should have been developed as part of the monitoring and evaluation process (Example 24). The post-evaluation process identifies the operational status (are beach clean-ups still regularly scheduled?) and impact (are the beaches cleaner than during the baseline?) of each intermediate objective, using contextual variables from previous monitoring and evaluation exercises, as well as the post-evaluation, to account for deviations from expected outcomes.

Post-evaluation Data Set #4

A number of factors outside the control of the CB-CRM project can influence the coastal ecosystem. Aspects of regional, national and international markets, including the potential for changes in commercialization of resource products, can impact CB-CRM processes. Issues such as demand and price can affect resource use and rule compliance (Pollnac 1984, Pomeroy 1995). Ostrom (1994:43–44) considers "rapid exogenous changes" as a threat to sustainable community-governed commons. In terms of coastal resources, the most threatening changes would be market-related variables discussed above, and technological changes. Externally developed technical changes diffuse rapidly throughout a fishery and can have multiple impacts on CB-CRM systems (Akimichi 1984, Matsuda and Kaneda 1984 Ohtsuka and Kuchikura 1984, Pollnac 1984, Miller 1989). For example, some changes might result in more efficient fishing technologies that could change the effectiveness of temporally based resource management regulations (open seasons). Others, such as more seaworthy, mechanized vessels could result in outsiders fishing long-distance in local waters. Other rapid exogenous changes that could impact a CB-CRM project are political instability which could influence enabling legislation, as well as constitute a variable antecedent to market instability. Natural or man-made disasters (for example, earthquakes, floods, wars, drought) can also impact the functioning of CB-CRM, and should be identified, if possible.

Most of these shocks to the system should be identified during the ongoing monitoring and evaluation process, but some may occur following the project end, and before post-evaluation. Some will be identified as part of replicating the baseline data gathering procedure during post-evaluation (new technologies, roads, markets, etc.). Nevertheless, all these potential and actual shocks should be compiled into one data set used to account for deviations from expected outcomes.

Post-evaluation Data Set #5

Sustainability of a project is based in large part on participants' reactions to the project. In turn, these reactions are based on users' perceptions of impacts, which are not always in accord with objective, quantifiable evidenceæwitness the number of people who continue to smoke cigarettes, despite overwhelming evidence of their negative effect on health. Further, user perception of the well-being of the natural environment is one indicator that, in some cases, will differ from that of resource scientists. For example, in cases where the natural environment was degrading in the past, a resource scientist would label a steady state as an improvement, or view it positively. Villagers would probably not have the same perspective on this type of change. Likewise, if restrictions are placed on fishing areas or methods, fishers may view decreased catches as indicating that CB-CRM activities are not improving the natural environment. Hence, if there is an interest in understanding sustainability of CB-CRM, it is essential to understand the community's perceptions of the present and possible future impacts of these projects. Perceptions of impacts may explain some of the variance in long-term, as well as short-term project success.

With respect to the human component of the ecosystem, the indicators most frequently mentioned (for example, income, material style of life, food, health), while extremely important, reflect for the most part material concerns. These are needs basic to maintaining life, but humans have other needs, social and psychological, such as family and community integration and self-actualization (Maslow 1954), which are also important to the well-being or quality of life of the human community. CB-CRM projects have the potential to influence the sense of fulfillment of some of these social and psychological needs. For example, CB-CRM projects, in general, reflect an ideological perspective directed at empowerment of community members, in terms of use of their resources. Further, CB-CRM activities such as consensus-building community meetings, if effective, should result in enhancement of an individual's perception of his or her ability to participate in, and influence, community affairs. Ideally, the meetings, themselves should reduce community conflict, leading to individual perceptions of harmony. The community's involvement in making decisions concerning aspects of the CRM should, in turn, influence perceptions of control over the resources. All this should enhance self-esteem. Finally, CB-CRM projects may impact aspects of coastal occupations. Occupational satisfaction is based on fulfillment of basic, as well as other social and psychological needs; hence, changes

affecting one's occupation may influence the level of job satisfaction. Extensive research has related job satisfaction to a host of variables impacting well-being, ranging from family violence and impaired social relations to psychosomatic illness and heart disease. (See Pollnac and Poggie 1988 for a review of this literature.) It appears, therefore, that it is important to determine community member's perceptions concerning changes, ranging from well-being of the resource to individual self-esteem (Pollnac and Pomeroy 1996). These indicators are as follows:

1. Overall well-being of individual family
2. Overall well-being of the resource
3. Local income
4. Access to resources
5. Control over resources
6. Ability to participate in community affairs
7. Ability to influence community affairs
8. Self-esteem
9. Community conflict
10. Community compliance with resource management
11. Amount of traditionally harvested resource in the water

The method used to evaluate changes in these indicators should be able to take advantage of the human ability to make graded ordinal judgements concerning both subjective and objective phenomena. For example, one has the ability to evaluate real world objects in terms of some attribute, such as size, and not only make the judgement that one is larger than the other, but also that one is a little larger, much larger, etc. Human behavior is based on graded ordinal judgements, not simply a dichotomous judgement of present or absent. For example, a person is more likely to take action if they perceive the activity will benefit them "greatly" in contrast to "just a little." This refined level of measurement allows one to make more refined judgements concerning CB-CRM impacts, and permits use of more powerful non-parametric statistical techniques to determine relationships between perceived impacts and potential predictor variables. There are several techniques that can be used to evaluate individual perception of the above indicators.[9]

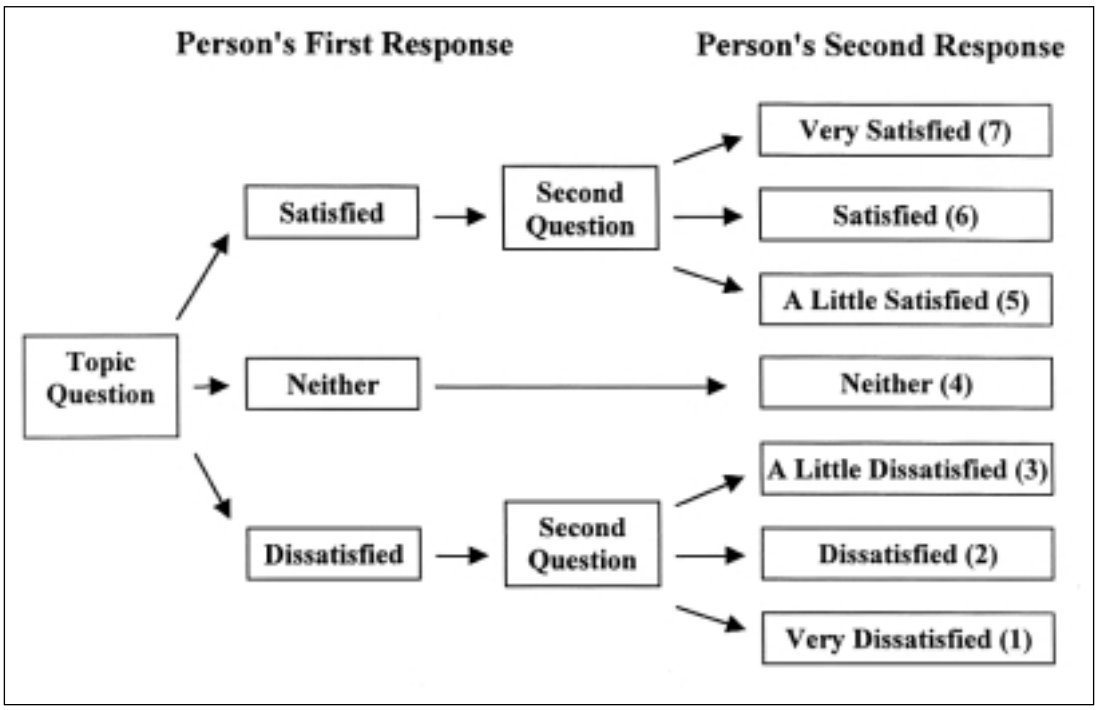
First, one could be requested to express degree of satisfaction or dissatisfaction along a seven (or other) point scale. This procedure would involve informing the subject that he/she will be requested to report how satisfied or dissatisfied they are with certain aspects

[9] The author is aware that psychologists, social psychologists and other social scientists have developed and tested multi-item scales for many of the indicators used in this study. Here, we are assuming that an overall perception, or *gestalt*, with respect to the indicator will be sufficient for our purposes. Additionally, if multi-item scales were used for each of the 11 indicators, the procedure would result in an unacceptably long research instrument, especially considering the fact that informants will be requested to make judgements for three time periods.

of their environment and living conditions. Then for each topic, the subject will be requested to respond "satisfied," "dissatisfied" or "neither." If they respond "satisfied," they will be asked if they are very satisfied, satisfied, or just a little satisfied. The same procedure would be applied to a "dissatisfied" response. Including the "neither," or neutral, response, this results in a seven-point scale, with one indicating very dissatisfied and seven very satisfied (see Figure 3). Respondents would be requested to make these judgements for three time periods: today, pre-CB-CRM project, and five years in the future. Clearly, this would be a cumbersome, time-consuming process with 11 indicators. Additionally, the technique might prove to be unreliable for uncovering small changes between time periods due to the size of the categories used.

Another technique which could be used is a visual self-anchoring ladder-like scale (see Figure 4) which would allow for making finer ordinal judgements,[10] place less demand on informant memory, and be administered more rapidly. Using this technique, the subject is shown a ladder-like diagram with, for example, 15 steps. The subject is told that the first step represents the worst possible situation. For example, with respect to coastal resources, the subject might be informed that the first step indicates an area with no fish or other resources, that the water is so foul nothing could live in it. The highest step could be described as clean water, filled with fish and other wildlife. The subject would then be asked

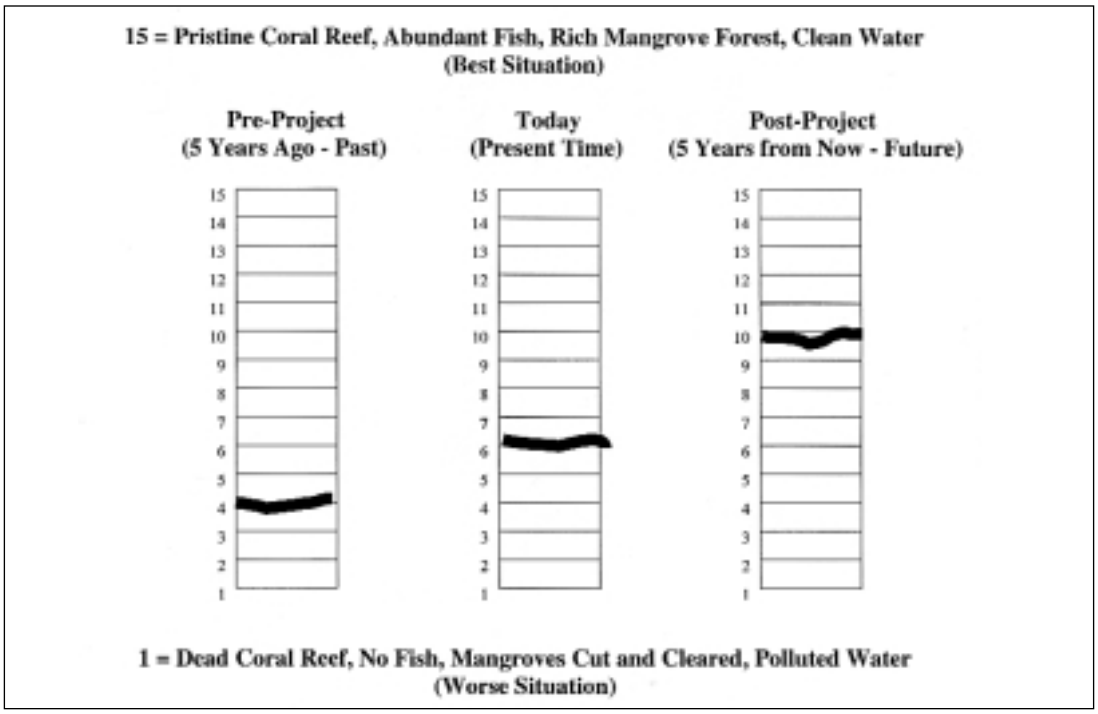
Figure 3: Evaluating individual perceptions using a multi-point scale



[10] It can be argued that such scales can be treated as "quasi-metric," permitting the use of parametric statistics with fewer reservations than with the previously discussed technique.

where on this ladder (ruler, scale, whatever is appropriate for the subjects involved) the local area is today (the self-anchoring aspect). The subject would then be asked to indicate where it was pre-CB-CRM and where he/she believes it will be five (or 10) years in the future. The two techniques do not provide exactly the same type of information. It is similar, but subject to slightly different interpretation. For example, a position on the self-anchoring scale does not necessarily indicate satisfaction or dissatisfaction, and we might be in error if we interpret a scale value above the mid-point as indicating individual satisfaction. Likewise, satisfaction with an attribute (income) does not tell us where in the perceived range of income the individual places him/herself. The self-anchoring scale, however, is both easier to administer and more sensitive to the changes we want to evaluate; hence, it is suggested as the most appropriate technique for the type of post-evaluation described in this guide. The following example is based on a post-evaluation of a CB-CRM in Calagcalag, the Philippines (Pollnac et al. 1996). The example is drawn from a study where the use of a control community was not funded and no baseline data was available. Controls within the community, e.g., households not participating in the project, were used as a substitute. Such a procedure is inadequate, since it could not be determined, for some of the variables, whether the improved economy in the Philippines impacted response patterns. For other variables, improvements perceived by both participants and non-participants might have been due to diffusion of project impacts within the community, a situation much less likely to occur using separate control communities, especially over a short period of

Figure 4: Example of a self-anchoring ladder indicating one respondent's perception of positive environmental changes compared to the past and future



time. Nevertheless, if the reader substitutes "sample from a control village" for "non-participants" in the following example, the study can provide a good illustration of the use of control sites selected at the time of post-evaluation.

Example 26: Post-evaluation of perceived changes in CB-CRM indicators

The CB-CRM project described below formed part of the nearshore fisheries component of the Central Visayas Regional Project (CVRP). As a means of determining perceived impacts on the coastal ecosystem, including both human and non-human elements, respondents were requested to provide evaluations of a number of aspects of this ecosystem for pre-project and present time periods. The technique used involved a visual, self-anchoring, ladder-like scale, which allowed for making relatively fine ordinal judgements, placed little demand on informant memory, and could be rapidly administered. Using this technique, the respondent was shown a ladder-like diagram with 15 steps. The respondent was told that the first step represents the worst possible situation. For example, with respect to coastal resources, the subject was informed that the first step indicates an area with no fish or other resources, that the water is so foul nothing could live in it. The highest step could be described as clean water, filled with fish and other wildlife. The subject was then asked where on the ladder the local area is today (the self-anchoring aspect of the scale). The subject was next asked to indicate where it was pre-CB-CRM. This was done for the following eleven impact indicators:

1. Access to resources (access)
2. Community compliance with resource management (compliance)
3. Community conflict (conflict)
4. Control over resources (control)
5. Amount of traditionally harvested resource in the water (harvest)
6. Overall well-being of individual household (household)
7. Local income (income)
8. Ability to influence community affairs (influence)
9. Ability to participate in community affairs (participate)
10. Overall well-being of the resource (resource)
11. Self-esteem (self-esteem)

The term in parentheses following each indicator is the abbreviated form used in the tables and discussion in the analysis below.

As a first step in the analysis, mean values (low is bad; high is good) for each indicator for "Today" and "Before" time periods were calculated, and a paired comparison t-test was calculated to determine if differences between means are statistically significant. The results of this analysis are in the table below.

Table 38: Perceived pre-project to post-project changes in indicators

	Today (T2)	Before (T1)	T2-T1	t-value	P
Access	7.6	9.1	-1.5	1.41	0.167
Compliance	10.4	5.1	5.2	6.48	<.001
Conflict	11.0	5.9	5.1	6.66	<.001
Control	9.4	5.8	3.6	3.33	0.002
Harvest	8.7	6.8	1.9	1.77	0.085
Household	7.4	5.5	1.9	3.18	0.003
Income	8.9	6.4	2.6	2.98	0.005
Influence	9.1	5.0	4.1	5.22	<.001
Participate	9.5	6.2	3.4	4.23	<.001
Resource	8.4	5.9	2.5	2.86	0.007
Self esteem	8.6	5.0	3.5	4.72	<.001

N=34

The results show an increase in perceived levels of all indicators except access, which is perceived as lower today than in the past. This reflects the lack of access to the area enclosed by the sanctuary, which is relatively large and visible, just offshore from the central part of Calagcalag. The difference, however, is not statistically significant ($p > 0.05$). The difference in perceived values for the harvest indicator is also not statistically significant. All other differences are statistically significant.

The next step was to determine if project participants differed from non-participants with respect to perception of change in the indicators. This was accomplished by subtracting the *pre-project* evaluation from the *today* evaluation for each indicator and calculating a two-sample t-test for the difference of mean values between the participant and non-participant samples. The results of this analysis, which can be found in Table 39, show that project participants are more positive on all indicators except conflict. (The difference with respect to conflict is minimal and not statistically significant.) The only differences that are statistically significant ($p < 0.05$) are *influence, participate, self-esteem,* and *resource.*

The Calagcalag nearshore fisheries component of the CVRP was apparently a success. From the perspective of the fisher households interviewed, there was a perceived improvement in all impacts assessed, except for access, which was related to the withdrawal of fishing area by the sanctuary. In compensation for loss of access, however, they noted that the sanctuary, which formed part of the project, has had, and will continue to have, a positive effect on the nearshore resources. As evident in Table 39, both participants and non-participants perceive positive changes for most indicators. This is probably due to the diffusion effect from project participants to non-participants within the community, an effect that

Table 39: Differences between project participants and non-participants with respect to perceived changes (T2-T1)

	Participants	Non-participants	t-test	p
Access	-0.2	-2.8	1.26	0.219
Compliance	5.4	5.1	0.18	0.858
Conflict	5.0	5.2	0.15	0.881
Control	4.4	2.7	0.79	0.433
Harvest	3.8	0.1	1.78	0.085
Household	2.6	1.1	1.38	0.176
Income	3.7	1.4	1.35	0.186
Influence	5.8	2.4	2.30	0.028
Participate	5.2	1.5	2.57	0.015
Resource	4.6	0.3	2.75	0.010
Self-esteem	5.1	2.0	2.16	0.039
N	17	17		

would be much less likely to occur between two separate villages. This is a desirable impact of a projectæif benefits accrue only to participants, new social strata will be created in the beneficiary community, potentially resulting in conflict, and weakening the ability of the community to work together for the common good. There were, however, some clearly positive impacts that accrued to the participants that could have a long-term positive impact on the community and its resources.

It is important to stress that the Calagcalag CB-CRM project was "…apparently a success." We say *apparently* because the evaluation was conducted without a true control, and evaluations of natural resource conservation projects need a control, especially when evaluations of the resource are involved. It is possible that perceived improvement of the resource is not the result of the project, but of some other factor, such as a change in oceanographic conditions (temperature, salinity, levels of pollution) which facilitate fish reproduction and/or growth. Likewise, improvement of household well-being could be either the result of the project or some unrecognized improvements in the context of the project community. This ambiguity applies less to improvements in community participation, influence, and self-esteem, but would these improvements occur if the resource had continued its downward slide to disaster?

4.4 PUTTING IT TOGETHER

Comparisons of the baseline data with the replicated baseline data collected at the time of post-evaluation will provide a wealth of information concerning project impacts. It will be possible to examine changes in all impact indicators, as well as the related variables in project communities, and compare these changes with those observed in non-project control sites, separating out the effects of project and non-project variables. Monitoring and evaluation reports concerning intermediate objectives (project interventions), such as marine sanctuaries, beach clean-ups, and local ordinances, and post-evaluations of these objectives will provide information on the contributions each made to ecosystem improvement. Data from replication of the baseline data collection procedure, monitoring reports, and post-evaluation examination of non-project variables can identify relevant contextual factors (shocks to the system), like drought, economic crises, new markets, political upheaval, or war. This information can be used to account for some aspects of variation from expected outcomes. Finally, community members' perception of change in key impact indicators, since project implementation, will provide a key perspective on expected outcomes—a perspective that may influence sustainability of the project's interventions.

In brief, the post-evaluation will provide information indicating what worked, what didn't and why. Whether or not the project is a success, the post-evaluation will provide direction for future projects, as well as future interventions in the project communities, if need be. If the project is successful, it will provide both justification and stimulus for its replication. It will also stimulate continuing efforts in the project area, and provide a report card, justifying the investment made by the community, funding agencies, and the public supporting the agencies.

For the post-evaluation to have this impact, the results must be communicated to all these interested entities. Clear descriptions of the types of information that support the findings can be conveyed back to the communities through public meetings, poster boards, clearly written reports, and the mass media. Reports to funding agencies can be more technical, demonstrating the amount of variance in key indicators attributable to project interventions, with explicit explanations of the methods and data used, further insuring that replication is possible. Finally, key portions of the analysis should be reported in technical papers for publication in professional journals for the peer-review essential to advancement of the science of coastal management.

REFERENCES CITED

Acheson, J. 1988. *The Lobster Gangs of Maine*. University Press of New England. Hanover, New Hampshire.

Akimichi, T. 1984. Territorial Regulation in the Small-Scale Fisheries of Itoman, Okinawa. In: *Maritime Institutions in the Western Pacific*. K. Ruddle & T. Akimichi, (eds.). Senri Ethnological Studies 17. National Museum of Ethnology. Osaka. Pp. 89–120

Alcala, A.C. and F.J. Vande Vusse. 1994. The Role of Government in Coastal Resources Management. In: *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences*. R.S. Pomeroy (ed.). ICLARM Conference Proceedings 45. ICLARM. Manila. Pp. 12–19.

ARD. 1996a. *Economic Value of Fisheries to the Residents of Bunaken National Marine Park*. Report No. 62. Associates in Rural Development. AID Contract No. 497-0362. USAID. Jakarta.

ARD. 1996b. *Sustainable Use and Conservation of the Mangrove Ecosystems of Bukanen National Park*. Report No. 74. Associates in Rural Development. AID Contract No. 497-0362. USAID. Jakarta.

Brown, R.C. 1998. Community-Based Cooperative Management: Renewed Interest in an Old Paradigm. In: *Reinventing Fisheries Management*. T.J. Pitcher, P.J.B. Hart, and D. Pauly (eds.). Kluwer Academic Publishers. Dordrecht.

Cantril, H. 1963. A Study of Aspirations. *Scientific American* 208:41–45.

Cattell, R.B. 1966. The Scree Test for Number of Factors. *Multivariate Behavioral Research* 1:245–276.

Cohen, J. 1988. *Statistical Power Analysis for the Behavioral Sciences*. Lawrence Erlbaum Associates. Hillsdale, NJ.

Crawford, B.R., C. Rotinsulu, J.D. Kusen, E. Mantjoro and A.J. Siahainenia. 1997. A Community-Based Coastal Resources Management Approach: Initial Baseline Surveys in the Villages of Bentenan and Tumbak, North Sulawesi, Indonesia. Presented at the *International Seminar on Maritime Communities in a Changing World*, Manado Indonesia, Sept. 23–26, 1997.

Doulman, D.J. 1993. Community-Based Fishery Management: Towards the Restoration of Traditional Practices in the South Pacific. *Marine Policy* 17(2):108–117.

Dyer, C.L. and J.R. McGoodwin, (eds.). 1994. *Folk Management in the World's Fisheries*. University Press of Colorado. Niwot, Colorado.

English, S., C. Wilkinson, and V. Baker (eds.). 1994. *Survey Manual for Tropical Marine Resources*. Australian Institute for Marine Sciences. Townsville, Australia.

EPA. 1994. *Measuring Progress of Estuary Programs: A Manual*. United States Environmental Protection Agency. Washington, D.C.

Feeney, D. 1994. Frameworks for Understanding Resource Management on the Commons. In: *Community Management and Common Property of Coastal Fisheries and Asia and the Pacific: Concepts, Methods and Experiences.* R.S. Pomeroy (ed.). ICLARM Conference Proceedings 45. ICLARM. Manila. Pp. 20–33.

Felt, L.F. 1990. Barriers to User Participation in the Management of the Canadian Atlantic Salmon Fishery: If Wishes Were Fishes. *Marine Policy* 14(4):345–360.

Firth, R. 1966. *The Malay Fishermen* (2nd Edition). Archon Books. Hamden, Connecticut.

Fox, P. 1986. *A Manual of Rapid Appraisal Techniques for Philippine Coastal Fisheries*. Bureau of Fisheries and Aquatic Resources Research Division. Manila.

GESAMP. 1996. *The Contributions of Science to Integrated Coastal Management*. GESAMP Reports and Studies No. 61. UNFAO. Rome.

Harwell, M.A. et al. 1999. A Framework for an Ecosystem Integrity Report Card. *BioScience* 49(7): 543–556.

Hedayat, A. and B.K. Sinha. 1991. *Design and Inference in Finite Population Sampling. W*iley. New York.

Henry, G.T. 1990. *Practical Sampling*. Sage Publications. London.

IIRR. 1998. *Participatory Methods in Community-Based Coastal Resources Management*. (3 vols.) International Institute of Rural Reconstruction. Silang, Cavite, Philippines.

Jentoft, S. 1989. Fisheries Co-Management: Delegating Government Responsibility to Fishermen's Organizations. In: *Marine Resource Utilization: Proceedings of a Conference on Social Science Issues*. J.S. Thomas, et al. (eds.). University of South Alabama College of Arts and Sciences and the Mississippi-Alabama Sea Grant Consortium. Mobile, Alabama.

Jentoft, S. and T. Kristoffersen. 1989. Fishermen's Co-Management: The Case of the Lofoten Fishery. *Human Organization* 48(4):355–365.

Kantor Statistik Kabupaten Minahasa. 1996. *Minahasa in Figures 1995*. Kantor Statistik Kabupaten Minahasa. Tondano, Indonesia.

Klee, G.A. 1999. *The Coastal Environment: Toward Integrated Coastal and Marine Sanctuary Management*. Prentice-Hall Inc. Upper Saddle River, New Jersey.

Kuperan Viswanathan, K. and N.M.R. Abdullah. 1994. Planning and Management of Small-Scale Coastal Fisheries. In: *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences.* R.S. Pomeroy (ed.). ICLARM Conference Proceedings 45. ICLARM. Manila. Pp. 115–123.

Mantjoro, E. 1997. An Ecological and Human History of Bentenan and Tumbak Villages. University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island.

Mantjoro, E. and M. Yamao. 1995. Fish Marketing Systems in North Sulawesi: The Development of Commercial Fisheries and Its Impact on Distribution of Fisheries Produce. *Bulletin of Fisheries Economy* 38(1):101–117.

Margoluis, R. and N. Salafsky. 1998. *Measures of Success: Designing, Managing, and Monitoring Conservation and Development Projects*. Island Press. Washington, D.C.

Maslow, A. 1954. *Motivation and Personality*. Harper and Row. New York.

Matsuda, Y. and Y. Kaneda. 1984. The Seven Greatest Fisheries Incidents in Japan. In: *Maritime Institutions in the Western Pacific*. Senri Ethnological Studies 17. K. Ruddle and T. Akimichi (eds.). National Museum of Ethnology. Osaka. Pp.159–182.

McGoodwin, J.R. 1990. *Crisis in the World's Fisheries: People, Problems, and Policies*. Stanford University Press. Palo Alto, California.

McManus, J.J., M.C.A. Ablan, S.G. Vergars, L.A.B. Menez, K.P.K. Reys, M.L.G. Gorospe and L. Halmarik. 1997. *Reef Base Aquanaut Survey Manual*. ICLARM Educ. Ser. 18. International Center for Living Aquatic Resources Management. Makati City.

Miller, D. 1989. The Evolution of Mexico's Caribbean Spiny Lobster Fishery. In: *Common Property Resources: Ecology and Community Based Sustainable Development*. F. Berkes (ed.). Belhaven Press. London.

Miller, R.J. 1990. Properties of a Nearshore Fishery. *Fisheries* 15(5):7–12.

Olsen, S. B., K. Lowry and J. Tobey. 1999. *The Common Methodology for Learning: A Manual for Assessing Progress in Coastal Management*. Coastal Management Report No. 2211. University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island.

Ostrom, E. 1994. Institutional Analysis, Design Principles and Threats to Sustainable Community Governance and Management of Commons. In: *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences*. R.S. Pomeroy (ed.). ICLARM Conference Proceedings 45. ICLARM. Manila. Pp. 34–50.

Ostrom, E. 1990. *Governing the Commons*. Cambridge University Press. New York.

Ohtsuka, R. and Y. Kuchikura. 1984. The Comparative Ecology of Subsistence and Commercial Fishing in Southwestern Japan, with Special Reference to Maritime Institutions. In: *Maritime Institutions in the Western Pacific*. K. Ruddle and T. Akimichi, (eds.). Senri Ethnological Studies 17. National Museum of Ethnology. Osaka. Pp.121–136.

Pido, M.D., R.S. Pomeroy, M.B. Carlos, and L.R. Garces. 1996. *A Handbook for Rapid Appraisal of Fisheries Management Systems*. International Center for Living Aquatic Resources Management. Makati City, Philippines.

Pinkerton, E. 1994. Summary and Conclusions. In: *Folk Management in the World's Fisheries*. Dyer, C.L. and J.R. McGoodwin (eds.). University Press of Colorado. Niwot, Colorado. Pp. 317–337.

Pinkerton, E. 1989. Introduction: Attaining Better Fisheries Management Through Co-ManagementæProspects, Problems, and Propositions. In: *Cooperative Management of Local Fisheries: New directions for Improved Management and Community Development*. E. Pinkerton (ed.). University of British Columbia Press. Vancouver.

PMO (Program Management Office), Fishery Sector Program, Dept. Agriculture, San Miguel Bay Management Council, and ICLARM. 1994. The San Miguel Bay Integrated Coastal Fisheries Management Plan. (Draft, May 1994 Revision). Unpublished Draft.

Pollnac, R.B. 1984. Investigating Territorial Use Rights Among Fishermen. *Maritime Institutions in the Western Pacific*. In: K. Ruddle and T. Akimichi (eds.). Senri Ethnological Studies 17. National Museum of Ethnology. Osaka, Japan. Pp. 285–300.

Pollnac, R.B. (ed.). 1989. *Monitoring and Evaluating the Impacts of Small-Scale Fishery Projects.* University of Rhode Island, International Center for Marine Resource Development. Kingston, Rhode Island.

Pollnac, R.B. 1994. Research Directed at Developing Local Organizations for People's Participation in Fisheries Management. In: *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences*. R.S. Pomeroy (ed.). International Center for Living Aquatic Resources Management. Manila, Philippines. Pp. 94–106.

Pollnac, R.B. 1998. *Rapid Assessment of Management Parameters for Coral Reefs*. University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island

Pollnac, R.B. and M.L.G. Gorospe. 1998. Aspects of the Human Ecology of Atulayan Bay. In: *Rapid Assessment of Management Parameters for Coral Reefs.* R. B. Pollnac (ed.). University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island. Pp. 77–139.

Pollnac, R.B. and J.J. Poggie. 1988. The Structure of Job Satisfaction Among New England Fishermen and Its Application to Fisheries Management Policy. *American Anthropologist* 90:888–901.

Pollnac, R.B. and J.J. Poggie (eds.). 1997. *Fish Aggregating Devices in Developing Countries*. University of Rhode Island, International Center for Marine Resource Development. Kingston, Rhode Island.

Pollnac, R.B. and R.S. Pomeroy. 1996. Evaluating Factors Contributing to the Success of Community Based Coastal Resource Management Projects: A Baseline Independent Method. Anthropology Working Paper No. 54. University of Rhode Island, Department of Anthropology and Coastal Resources Center. Kingston, Rhode Island.

Pollnac, R.B., R.S. Pomeroy, C. Predo, J. Mayordomo, and M.L.G. Gorospe. 1996. Post-Evaluation of the Calagcalag Community-Based Coastal Resource Management Project. Anthropology Working Paper No. 53. University of Rhode Island, Department of Anthropology and Coastal Resources Center. Kingston, Rhode Island.

Pollnac, R.B., C. Rotinsulu, A. Soemodinoto. 1997a. *Rapid Assessment of Coastal Management Issues on the Coast of Minahasa*. University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island.

Pollnac, R.B., F. Sondita, B. Crawford, E. Mantjoro, C. Rotinsulu and A. Saihainenia. 1997b. *Baseline Assessment of Socio-Economic Aspects of Resource Use in Bentenan and Tumbak*. University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island.

Pollnac, R.B., B.R. Crawford, C. Rotinsulu, P. Kussoy and A. Siahainenia. 1998. *An Examination and Comparison of Rumbia and Minanga: Control Sites for the Coastal Resource Management Project Sites at Bentenan and Tumbak*. University of Rhode Island, Coastal Resources Center. Narragansett, Rhode Island.

Polotan-de la Cruz, L. (ed.). 1993. *Our Sea Our Life*. Voluntary Services Overseas. Quezon City, Philippines.

Pomeroy, C. 1994. Obstacles to Institutional Development in The Fishery of Lake Chapala, Mexico. In: *Folk Management in the World's Fisheries*. Dyer, C.L. and J.R. McGoodwin, (eds.). University Press of Colorado. Niwot, Colorado. Pp. 43–54.

Pomeroy, R.S. 1995. Community-Based and Co-Management Institutions for Sustainable Coastal Fisheries Management in Southeast Asia. *Ocean and Coastal Management* 27(3):143–162.

Pomeroy, R.S. 1994a. Introduction. In: *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences.* R.S. Pomeroy (ed.). ICLARM Conference Proceedings 45. ICLARM. Manila, Philippines. Pp. 1–11.

Pomeroy, R.S. (ed.). 1994b. *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences*. International Center for Living Aquatic Resources Management. ICLARM. Manila, Philippines.

Pomeroy, R.S. and M.B. Carlos. 1997. Community-Based Coastal Resource Management in the Philippines: A Review and Evaluation of Programs and Projects. *Marine Policy* 21(5):445–464.

Pomeroy, R.S. and M.D. Pido. 1995. Initiatives Towards Fisheries Co-Management in the Philippines: The Case of San Miguel Bay. *Marine Policy* 19(3):213–226.

Pomeroy, R.S., R.B. Pollnac, C.D. Predo and B.M. Katon. 1996. *Impact Evaluation of Community Based Coastal Resource Management Projects in the Philippines*. Fisheries Co-Management Research Project Research Report No. 3. International Center for Living Aquatic Resources Management. Manila, Philippines.

Pomeroy, R.S., R.B. Pollnac, B.M. Katon and C.D. Predo. 1997. Evaluating Factors Contributing to the Success of Community-Based Coastal Resource Management: The Central Visayas Regional Project-1, Philippines. *Ocean and Coastal Management* 36(1–3):97–120.

Profil Desa. 1997a. *Profil Desa/Kelurahan Buku I (Desa Bentenan, Kecamatan Belang, Kabupaten Minahasa, Propinsi Sulawesi Utara, 1997.)* Departemen Dalam Negeri, Republik Indonesia.

Profil Desa. 1997b. *Profil Desa/Kelurahan Buku I (Desa Tumbak, Kecamatan Belang, Kabupaten Minahasa, Propinsi Sulawesi Utara, 1997.)* Departemen Dalam Negeri, Republik Indonesia.

Roldan, R.B. and R.F. Sievert. 1993. *Coastal Resources Management: A Manual for Government Officials and Community Organizers*. FSP. Dept. of Agriculture. Manila, Philippines.

Ronquillo, I.A. 1950. Anatomical Evidence in Cases of Fish Killed by Explosives. *Bulletin of the Fisheries Society of the Philippines* 1:52–56.

Rosander, A.C. 1977. *Case Studies in Sample Design*. M. Dekker. New York, New York.

Russ, G.R. and A.C. Alcala. 1989. Effects of Intense Fishing Pressure on an Assemblage of Coral Reef Fishes. *Marine Ecology Progress Series* 56:13–27.

Tabunda, M.S. and M.M. Galang. 1992. *A Guide to the Local Government Code of 1991*. Mary Jo Educational Supply. Manila, Philippines.

Tagarino, R.N., R.G. Corcolon, D.D. Elazegui, and P.G. de Guzman. 1995. *Local Government Initiatives in Fishery Resources Management: Its Implications on Sustainability*. University of the Philippines, Los Banos. Center for Policy and Development Studies. Los Banos, Laguna, Philippines.

Talaue-McManus, L. and T.E. Chua. 1997. The Lingayen Gulf Experience: If We Have to Do It Again. *Ocean and Coastal Management*. 37(2):217–32.

Thomas, P. 1991. Coastal and Marine Tourism: A Conservation Perspective. In: *Proceedings of the 1990 Congress on Coastal and Marine Tourism*. Miller, M.L. and J. Auyong, (eds.) Vol. 1:18–22. National Coastal Resources Research and Development Institute. Newport, Oregon.

Townsley, P. 1993. *Rapid Appraisal Methods for Coastal Communities: A Manual*. Bay of Bengal Program. Madras, India.

van Mulekom, L. 1999. An Institutional Development Process in Community-Based Coastal Resource Management: Building The Capacity and Opportunity for Community- Based Co-Management in a Small-Scale Fishers Community. *Ocean and Coastal Management* 42(5):439–456.

Vande Vusse, F.J. 1991. A Community-Based Resource Management Approach to Address Philippine Coastal Resource Degradation and Overfishing. In: *Towards an Integrated Management of Tropical Coastal Resources*. L.M. Chou et al. (eds.). ICLARM Conference Proceedings 22. International Center for Living Aquatic Resources Management. Manila, Philippines.

Walters, J.S., J. Maragos, S. Siar and A.T. White. 1998. *Participatory Coastal Resource Assessment: A Handbook for Community Workers and Coastal Resource Managers.* Coastal Resource Management Project and Silliman University. Cebu City, Philippines.

White, A.T. 1989. Two Community-Based Marine Reserves: Lessons for Coastal Management. In: *Coastal Area Management in Southeast Asia: Policies, Management Strategies and Case Studies*. T.E. Chua and D. Pauly (eds.). ICLARM Conference

Proceedings 19. International Center for Living Aquatic Resources Management. Manila, Philippines.

White, A.T., L.Z. Hale, Y. Renard, and L. Cortesi. 1994a. The Need for Community Based Coral Reef Management. In: *Collaborative and Community Based Management of Coral Reefs*. A.T. White, L.Z. Hale, Y. Renard and L. Cortes, (eds.). Kumarian Press. West Hartford, Connecticut. Pp. 1–18.

White, A.T., L.Z. Hale, Y. Renard, and L. Cortes, Eds. 1994b. *Collaborative and Community Based Management of Coral Reefs*. Kumarian Press. West Hartford, Connecticut.

White, L.G. 1986. *An Approach to Evaluating the Impact of A.I.D. Projects*. A.I.D. Program and Design Methodology Report No. 5. U.S. Agency for International Development. Washington, D.C.

Whitten, A. J., Muslimin Mustafa and G. S. Henderson. 1987. *The Ecology of Sulawesi*. Gadja Mada University Press. Yogyakarta, Indonesia.

World Bank. 1999. *Voices from the Village: A Comparative Study of Coastal Resource Management in the Pacific Islands*. Draft report (not for circulation). Pacific Islands Discussion Paper Series, No. 9, East Asia and Pacific Region, Papua New Guinea and Pacific Islands Country Management Unit. The World Bank. Washington, D.C.